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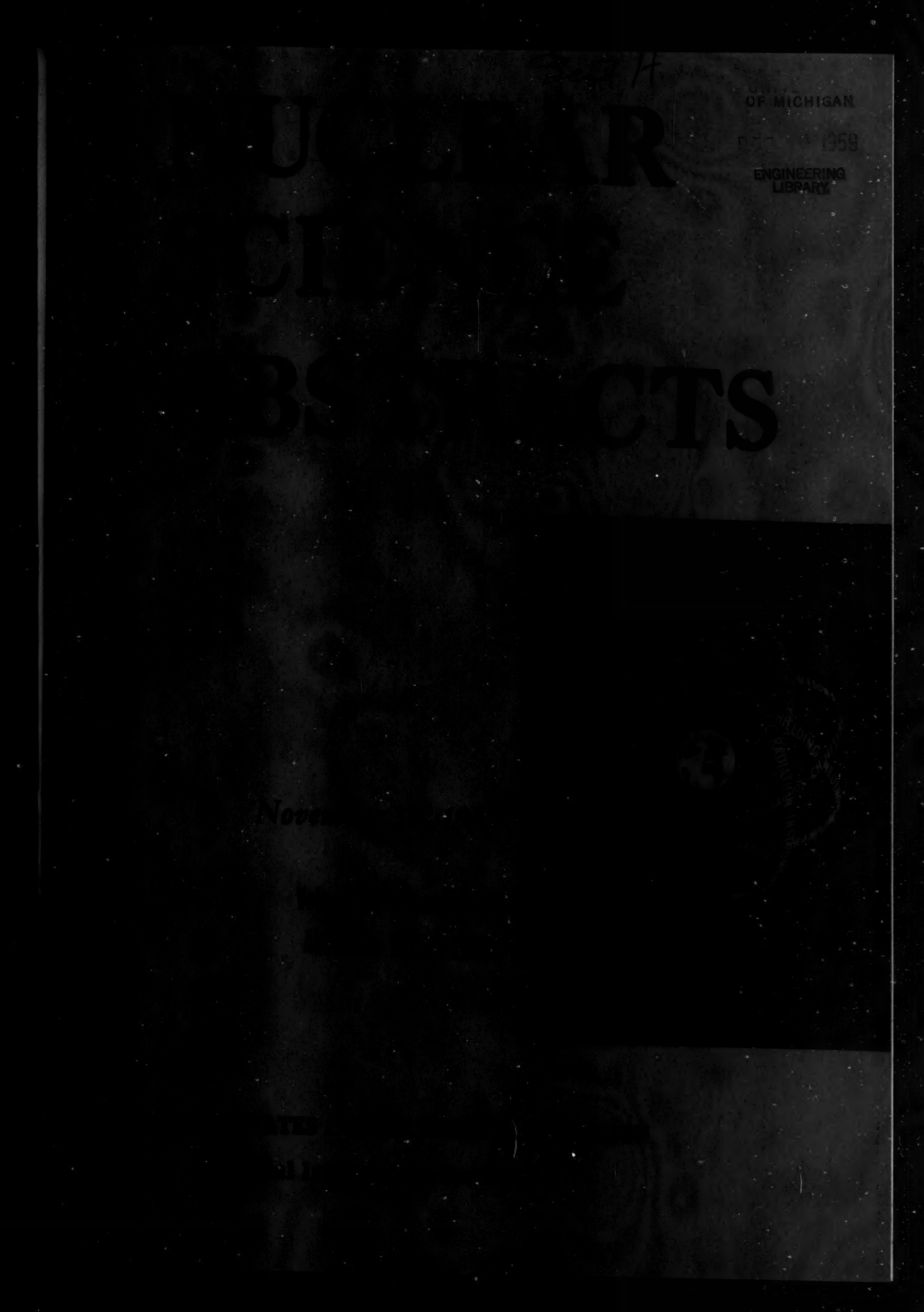

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NUCLEAR SCIENCE ABSTRACTS

Volume 13 Number 22 November 30, 1959

GENERAL

19759 ARF-TM-421

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

NEW CONCEPTS FOR CONTROL AND USE OF NUCLEAR EXPLOSIONS. Francis B. Porzel. Apr. 29, 1959. 33p. $6.30(ph), $3.00(mf) OTS.

New and basic concepts are presented for the control and use of nuclear explosions in peaceful applications. Concepts and applications of waste heat and channeling are discussed. The waste heat concept provides a categorical method for the control and use of an explosion by control of the properties of the medium surrounding the bomb or energy source; the applications are possible because of non-linearity of the equation of state for compression. The channeling concept provides a categorical method for control and use of an explosion by control of the geometry of the material surrounding the energy source; the applications are possible mostly because of the non-linearity in the shock velocity and in the material velocity behind the shock. It is pointed out that there are far better available sources in the world for heat, power, and energy than from contained nuclear explosions. However, nuclear explosions possess unique capabilities for pressures and temperatures which ordinary chemical fuels will never make available, and they are a cheap source of energy when they can be used. Applications of these concepts in reactor containment are discussed in detail. Other possible applications of present fission or fusion weapons include: a power source for driving a heat engine; a heat source for driving a heating plant; in a high-temperature batch smelter; in the cheap production of isotopes; as a power source on planets or remote places using natural soil as the absorber fuel; to provide new chemical fuels and industrial materials; for safe and convenient nuclear tests; to use up stock-piles of fissionable material on peace time applications; in building harbors, canals, roadbeds, tunnels, mines, oil fields, and large road cuts; for climate control by means of canals to make inland seas or to divert ocean currents through existing land blocks; in the control of natural earthquakes by relieving seismic stresses before they become dangerous; and for the diversion of lava flow from volcanoes. (C.H.)

19760 BAW-1053

Babcock and Wilcox Co. Atomic Energy Div., Lynchburg, Va.

GRAPHITE-TO-METAL SEAL SCREENING TESTS, SEPTEMBER 1958. J. S. Gilhart. Changed from OFFICIAL USE ONLY July 10, 1959. 21p. Contract AT(30-1)-1940. $3.30(ph), $2.40(mf) OTS.

A seal which will hold bismuth with a practical interface contact pressure was developed between graphite and steel. No resort to complicated and difficult interface configurations was necessary to obtain the seal. Pile grade graphite, specifically MH4LM, was found to have an impervious shell about $\frac{1}{8}$ in. thick. This impervious shell extended into the graphite from all exposed surfaces. The impervious shell of the graphite had a minor absorption affinity for bismuth. The relatively porous part of the graphite absorbed about 4% of bismuth by weight. An existing commercial grade of graphite was successfully treated, which reduced the penetration of bismuth to a negligible amount. (auth)

19761 NP-7839

Italy. Comitato Nazionale per le Ricerche Nucleari, Milan.

SEGNALAZIONI BIBLIOGRAFICHE, NO. 5, VOL. II, DA NO. 2014–2486. (Bibliographic Announcements, No. 5, Vol. II, DA No. 2014–2486.) Mar. 15, 1959. 87p.

Varied language title list (including English).

A bibliography of reports and journal articles of interest to the biologist, chemist, physicist, geologist, engineer, and mathematician working in the field of nuclear science is presented. (J.S.R.)

19762 NP-7863

SCIENTIFIC AND RESEARCH INSTITUTIONS IN HUNGARY: I. NUCLEAR SCIENCE. Elias Bacha. May 22, 1959. 22p.

Scientific and research institutions in Hungary engaged in research in the field of nuclear science are discussed. Brief descriptions are included of the Central Research Institute of Physics, the Institute of Nuclear Research, the Joliot-Curie Central Research Institute of Radiobiology, and the Physics Laboratory of the Otvos Lorand Radium and X-Ray Institute. The recently completed experimental reactor at Budapest and isotope research laboratories are described. Plans for an atomic power plant are discussed. Uranium deposits in Hungary are also discussed. A list of recent publications in the field of nuclear science is included. (C.H.)

19763 NP-7864

THE NUCLEAR PHYSICS INSTITUTE OF THE UZBEKSKAYA SSR ACADEMY OF SCIENCES. Elias Bacha. Apr. 30, 1959. 10p.

The organization and work of the Institute of Nuclear Physics of the Academy of Sciences of Uzbekskaya SSR are described. It is planned that the Institute will serve primarily the interests of the Central Asian republics

for research connected with the use of atomic energy for peaceful purposes. (C.H.)

19764 NP-tr-287

RADIOACTIVE ISOTOPES IN THE PETROLEUM INDUSTRY. (Radioaktivnye Izotopy v Neftyanoy Promyshlennosti). Yu. S. Zaslavskii (Zaslavskiy) and S. E. Krein (Kreyn). Translated for Wright-Patterson AFB, Ohio, from Priroda 46, No. 8, 35-44(1957). 21p. OTS.

The radiometric prospecting for petroleum deposits by measuring the gamma radiation in a thin upper layer of soil is described. The use of radiometry in the study of oil well rock formation, age of rocks, and distribution and extent of oil saturation is discussed. The use of radioactive isotopes in developing oil fields and operating wells is described. The use of atomic energy in oil refining to initiate chemical reactions, polymerization, and cracking is described. (W.L.H.)

19765

LONG RANGE CLOUD DIFFUSION IN THE LOWER ATMOSPHERE. B. P. Leonard, Jr. (Convair, Fort Worth, Tex.). J. Air Pollution Control Assoc. 9, 77-82(1959) Aug.

Long-range cloud diffusion is anisotropic, regardless of weather conditions, due to suppression of large-scale turbulence by the ground. Anisotropic diffusion is greatly magnified under stable atmospheric conditions due to increased suppression of large-scale turbulence. Cloud concentrations at large distances are roughly inversely proportional to the diffusion distance with a major portion of the diffusion occurring in the horizontal plane. This effect is relatively insensitive to weather conditions. Cloud dimensions and, therefore, concentrations differ significantly with weather conditions. This is due almost entirely to differences in diffusion rates in the first one to three miles of diffusion distance. (auth)

19766

CONCERNING THE INFLUENCE OF IONIZING RADIATION ON THE DISPERSITY OF AEROSOLS. V. F. Dunskii and N. S. Smirnov (Inst. of Mineral Fuels, Academy of Sciences, U.S.S.R.). Kolloid. Zhur. 21, 436-41(1959). (In Russian)

It was shown experimentally that condensation fogs are charged very slowly under the natural conditions of atmospheric ionization. Irradiation by γ quanta of Co^{60} of a stream of such fogs influences the decrease in dispersity of the microscopic particles and facilitates filtration of the finer fractions of the fog. (auth)

19767

DISTURBANCE IN THE IONOSPHERIC F-REGION FOLLOWING THE JOHNSTON ISLAND NUCLEAR EXPLOSION. C. H. Cummack and G. A. M. King (Dept. of Scientific and Industrial Research, Christchurch, N. Z.). Nature 184, 32-3 (1959) Sept. 5

Ionograms at Rarotonga showed the normal undisturbed night F-region on August 1, 1958. A sudden increase in maximum electron density was noted which within ten minutes exceeded the recording limit of the machine. In the next forty minutes the electron density decreased rapidly and after one hundred minutes there was no trace of the normal F-region, but above it at a base height of 560 km was seen a layer the maximum electron density of which was roughly one quarter of the normal F-value. The increase at the maximum phase was to at least seven times normal. Another interesting characteristic was the gradual drop of fifty kilometers in height as the ionization decayed. On August 12 another disturbance in the ionosphere F-region was observed which was much less severe. Ten-minute recordings were made over the period of the first event and two-minute recordings over the period of the second event. The disturbances are related to published accounts of the American explosion of hydrogen bombs near Johnston Island on August 1 and 12, at heights of 160 km and 100 km. Ionograms from other stations were examined for a better picture of the physical processes. Observations are discussed. The data indicate electron production in the disturbance. It is postulated that ionization occurred by collision and subsequent removal by attachment or re-combination in a region of relatively high gas pressure. The spatial form of the ionospheric disturbance is presented graphically as deduced from the Rarotonga ionograms for the event of August 1. (C.H.)

19768

GEOMAGNETIC AND IONOSPHERIC PHENOMENA ASSOCIATED WITH NUCLEAR EXPLOSIONS. S. Matsushita (Univ. of Colorado, Boulder). Nature 184, 33-4 (1959) Sept. 5.

Nuclear explosions at high altitudes were carried out at Johnston Island on August 1 and on August 12, 1958. Geomagnetic and ionospheric effects associated with these events are described. The data were collected at various stations in the Pacific area and the American continent. (C.H.)

19769

MAGNETIC EFFECTS RESULTING FROM TWO HIGH-ALTITUDE NUCLEAR EXPLOSIONS. J. A. Lawrie, V. B. Gerald, and P. J. Gill (Dept. of Scientific and Industrial Research, Christchurch, N. Z.). Nature 184, 34; 51-2(1959) Sept. 5.

On August 1 and 12, 1958, two nuclear devices were exploded in the upper atmosphere above Johnston Island in the North Pacific. Unusual magnetic effects were recorded after both explosions. Vector diagrams were prepared of the variations in a horizontal plane. Based on these diagrams, the effects are classified into four phases. Interpretations are presented for each phase. (C.H.)

19770

SOME GEOMAGNETIC PHENOMENA ASSOCIATED WITH NUCLEAR EXPLOSIONS. R. G. Mason and M. J. Vitousek (Scripps Institution of Oceanography, La Jolla, Calif.). Nature 184, 52-4 (1959) Sept. 5.

Magnetic disturbances following the various nuclear tests conducted by the British in the vicinity of Christmas Island during 1958 are described. The British tests are believed to have occurred at relatively low altitudes in the lower atmosphere. Magnetograms from three observation stations are reproduced, and vector diagrams are included of the distrubance in the vertical plane. Data are compared with data from the Johnston Island high-altitude explosion of August 1, 1958. It is concluded that no simple explanation of the magnetic phenomena is to be expected. Data indicate that several distinctly separate mechanisms are involved. (C.H.)

19771

CALCULATION OF A 'COSMIC RAY AGE' FOR THE IRON METEORITE 'CARBO'. Royal R. Marshall (Universität, Bern). Nature 184, 117-18(1959) July 11.

The accuracy of the cosmic-ray age calculated from the potassium produced by spallation depends principally upon how well the ratio of the formation cross sections for the potassium-40 and potassium-41 is

known and the constancy of the cosmic-ray flux. The calculated age of 0.69×10^9 years agrees remarkably well with independent age determinations for this meteorite and other meteorites. (C.J.G.)

19772
THE DETECTION OF NUCLEAR EXPLOSIONS. J. Carson Mark (Los Alamos Scientific Lab., N. Mex.). Nucleonics 17, No. 8, 64-73(1959) Aug.

Radioactive debris is the only specifically nuclear indication of an explosion that is available for analysis at large distances. Various environments in which an explosion might be staged, signals that might be propagated, instrumentation that might be effective in recording these signals, and the problem of sorting out signals of nuclear events from natural or man-made non-nuclear events are fully considered. (C.J.G.)

19773
THE CRAB AND CYGNUS A AS GAMMA RAY SOURCES. M. P. Savedoff (Univ. of Rochester, N. Y.). Nuovo cimento (10) 13, 12-18(1959) July 1.

The Crab is estimated to give a maximum nuclear γ-ray flux of 10^{-2} cm^{-2} s^{-1} from the decay of Cf^{251} formed with Cf^{253} during the supernova outburst. Although extrapolation of the radio and visual fluxes suggests the possibility of a flux as high as 10 γ cm^{-2} s^{-1} between 1 and 2 Mev, model calculations suggest that 7×10^{-5} γ cm^{-2} s^{-1} above about 10 Mev is more probable. Bremsstrahlung and Compton scattering yield considerably lower fluxes. Cygnus A, regarded as the result of a collision of matter and antimatter, should yield lower fluxes than the γ cm^{-2} s^{-1} estimated by Morrison. The radio flux suggests a π^0 decay γ flux of 4×10^{-5} γ cm^{-2} s^{-1}. For E > 10 Mev, any γ-ray flux exceeding 5×10^{-5} γ cm^{-2} s^{-1} should be detectable from a balloon flown emulsion stack. (auth)

19774
THE ARMY TRAINING PROGRAM FOR NUCLEAR POWER PLANT PERSONNEL. Presented at Nuclear Engineering and Science Conference, April 6-9, 1959, Public Auditorium, Cleveland, Ohio. Preprint V-11. Daniel C. King, Joseph Lafleur, and Walter Eager (Fort Belvoir, Va.). New York, Engineers Joint Council, 1959. 15p. $0.50.

The Army Nuclear Power Plant Operators Course is training personnel of the three services for the operation of military nuclear power plants. A description is given of student selection procedures and of purpose, curriculum, and facilities of the school. (auth)

19775
NUCLEAR POWER DEVELOPMENT IN ITALY. Presented at Nuclear Engineering and Science Conference, April 6-9, 1959, Public Auditorium, Cleveland, Ohio. Preprint V-66. Nestore B. Cacciapuoti (Italian Embassy, Washington, D. C.). New York, Engineers Joint Council, 1959. 18p. $0.50.

Electric power needs in Italy show an average annual increase of 7%. National reserves of conventional energy sources are almost fully exploited. Development of thermo-electric power supply is actually limited by the possibilities and costs of imported conventional fuels. As nuclear energy seems the most attractive solution to balance Italy's increasing needs, a national program has been established since 1952. (auth)

19776
DESIGN AND PERFORMANCE CHARACTERISTICS OF SNAP-III-B. Presented at Nuclear Engineering and Science Conference, April 6-9, 1959, Public Auditorium, Cleveland, Ohio. Preprint V-132. Melvin Barmat (Martin Co., Baltimore). New York, Engineers Joint Council, 1959. 24p. $0.50.

The design philosophy and problems met during the construction of the first two radioisotope-fueled thermoelectric generators by the Martin Nuclear Division under the SNAP-III program are discussed. Besides detailing the original specifications, the most up-to-date information on the actual performance of the unit that was available on April 6, 1958, is included. (auth)

BIOLOGY AND MEDICINE

19777 AECU-4330
[Chicago, Univ.]
FINAL REPORT [ON STUDY TO DETERMINE CARCINOGENIC EFFECT OF RADIATION UPON ORGANS WITHIN THE PORTALS OF RADIATION]. [1959?]. 3p. Contract AT(11-1)-98. $1.80(ph), $1.80(mf) OTS.

An investigation was proposed of the possible carcinogenic effects resulting from the treatment of peptic ulcer by roentgen irradiation to the body and fundus of the stomach. Data were available covering a 20-year span since the onset of such therapy. Problems encountered in selecting an appropriate comparative group are discussed. Many non-mathematical considerations presented themselves. After careful consideration of the magnitude of the task involved and the additional investment of time, it was concluded that a group of medically treated non-irradiated ulcer patients should be subjected to a follow-up study. No other group would provide a satisfactory control. (C.H.)

19778 AMRL-60
Army Medical Research Lab., Fort Knox, Ky.
PROTECTION OF SINGLE CELLS AND SMALL CELL GROUPS AGAINST RADIATION. S. Bellack and A. T. Krebs. July 10, 1951. 18p. Project No. 6-64-12-06-(43), Sub-project AMRL 06-(43).

The protective effects against radiation injury of a number of chemicals were investigated in onion epidermis cells exposed to x radiation both before and after treatment. A protective effect was observed for cysteine, glutathione, and acetone. No protection was attained with cystine, urea, and NaCl solutions. (C.H.)

19779 ORO-208
Arkansas. Univ., Little Rock. School of Medicine.
TO INVESTIGATE, DEVELOP, AND EVALUATE RADIOISOTOPES FOR TELETHERAPY. Final Report. Sept. 30, 1959. 19p. Contract AT-(40-1)-1771. $3.30 (ph), $2.40(mf) OTS.

Of 87 cancer patients treated with focused grid telecobalt therapy, 51 patients received appreciable palliation and 21 patients excellent palliation as evidenced by diminution of pain and other symptoms and decrease in tumor size for a significant period following irradiation. Bladder malignancies were the most responsive, whereas lung carcinoma was least responsive. Results are included from dosage studies using both mice and phantoms. (C.H.)

19780 TID-3516(Suppl. 1)
Technical Information Service Extension, AEC.
RADIOISOTOPES IN AGRICULTURE; FERTILIZER UPTAKE, PLANT PHYSIOLOGY, PHOTOSYNTHESIS, AND ENTOMOLOGY. A Selected List of References.

J. A. McCormick, comp. Sept. 1959. 22p. $0.75 (OTS).

This bibliography contains 151 selected references on the uses of radioactive and stable isotopes in animal husbandry and in studies of fertilizer uptake by plants, plant physiology, photosynthesis, and entomology. These references were selected from scientific journals published during the period 1957 to 1958. An author index is included. (auth)

19781 TID-5564

Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex.

BIOLOGICAL BLAST EFFECTS. Clayton S. White. Sept. 1959. 51p. $0.50(OTS).

Presented at the Hearings on the Biological and Environmental Effects of Nuclear War, Before the Special Subcommittee on Radiation, Joint Committee on Atomic Energy.

The scope and nature of several blast hazards are delineated. Tentative criteria are set forth for threshold damage to humans. These criteria are related to nuclear weapons in terms of ground ranges and areas involved for one MT and ten MT surface detonations. To allow appreciation of the relative importance of blast with other effects, appropriate values are noted for ionizing and thermal radiation. Four categories of blast hazards are defined, and the character of each is described. The occurrence of combined injuries from pressure, missiles, and displacement is discussed. Experiences in the Texas City disaster of 1947 are reviewed. Selected data relate environmental conditions to gross biologic damage from overpressures, missiles, and impact loading. 86 references. (C.H.)

19782 UCLA-443

California. Univ., Los Angeles. School of Medicine.

MORPHOLOGY AND FUNCTIONAL RELATIONS OF SEX CHROMATIN IN CULTURED AMNION CELLS. Charles P. Miles. July 14, 1959. 28p. Contract AT-04-1-Gen-12. $4.80(ph), $2.70(mf) OTS.

Sex chromatin is a large chromatin mass occurring in many human female nuclei but in few or no male nuclei. In vitro studies have revealed that about 25% of sex chromatin clumps in female amnion cells in tissue culture may be distinguished from comparable male clumps solely by virtue of the characteristic morphology of the female clump. Peripheral chromatin clumps in male nuclei are significantly less than half the size of female clumps. Non-peripheral chromatin masses of size comparable to sex chromatin occur in the nuclei of both sexes, but with a higher incidence in female cells. Sex clumps of characteristic form are seldom evident at any stage of mitosis, and the incidence of peripheral sex clumps varies inversely with the number of mitoses in the culture. After treatment with hypotonic saline, sex chromatin is no longer seen. Nucleoli are often seen close to or merged with sex clumps. Occasional appearances suggest excretion of material through the nuclear membrane in the vicinity of the sex chromatin. (auth)

19783 UR-554

Rochester, N. Y. Univ. Atomic Energy Project.

DISTRIBUTION AND EXCRETION OF INDIUM-114m AFTER MULTIPLE INTRAMUSCULAR INJECTION TO THE RAT. Geneva A. Smith, Robert G. Thomas, and James K. Scott. June 23, 1959. 65p. Contract W-7401-eng-49. $10.80(ph), $3.90(mf) OTS.

Distribution and excretion of indium-114m were studied after multiple intramuscular injection in rats over a period of one year. It was found to distribute throughout the body concentrating somewhat in glandular tissues, spleen, and kidney in a pattern similar to that seen after single injections. Spleen and salivary glands, however, increased in relative indium concentration after multiple administration. After it had been absorbed from the injection site, the indium left the body burden at a rate that was approximately exponential with an effective half-time of 38.3 days. The same kinetics were followed independently of the number of doses given. Excretion occurred in both feces and urine in two phases, each of which could be described by some exponential function. Maximum permissible concentrations of indium-114m were calculated using whole body, spleen, and kidney as possible critical organs. The values calculated on the basis of these data were compared with existing values as reported in NBS Handbook 69. Sarcomas were observed in several animals at the injection sites having two doses of indium. Microscopic examinations of these tissues were made, and further experiments to show whether these tumors were indium or radiation induced are discussed. (auth)

19784 CEA-tr-R-690

EFFETS DES SUBSTANCES ANTIHISTAMINIQUES ET HYPNOTIQUES SUR L'ÉVOLUTION DE LA RÉACTION CUTANÉE PROVOQUÉE LOCALEMENT PAR LES RAYONNEMENTS DU PHOSPHORE RADIOACTIF. (Effects of Antihistamine and Hypnotic Substances on the Evolution of the Skin Reaction Caused Locally by Radiations of Radiophosphorus.) V. S. Minassov. Translated into French from Vestnik Rentgenol. i Radiol. No 3, 76-9(1958). 9p.

The effects of barbamyl and dimedrol on the cutaneous reaction induced by beta radiation in rabbits were investigated. The rabbits were exposed to 800 r under various conditions. The first group received a subcutaneous injection of barbamyl one hour before irradiation and an injection on the next two days. The second group was injected with dimedrol before irradiation, and the third group had a simultaneous dose of both drugs. A fourth group received no medication, but the radiation was administered in fractionated doses of 200 r each. A fifth group served as control. The sleep induced by the barbamyl and dimedrol reduces the skin reaction during the local action of the radiophosphorus. The simultaneous use of both medications gave the most protection. Pathological studies showed that under the effect of barbamyl (and to a less degree from dimedrol) there is a definite lowering of the atypical phenomenon of epidermal cells and a disappearance of the boundary between the epidermis and the dermis. Fractionated doses cause less of a reaction than the single dose. (J.S.R.)

19785 CEA-tr-R-693

ACTION DES AGENTS COMPLEXANTS SUR L'ELIMINATION DES RADIOISOTOPES DU STRONTIUM, DE L'YTTRIUM ET DU CÉRIUM. (Action of Complexing Agents on the Elimination of Radioisotopes of Strontium, Yttrium, and Cerium.) Iu. I. Moskalev and L. N. Budno. Translated into French from Med. Radiol. 3, No. 5, 50-8(1958). 23p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 2674.

19786

MICRURGICAL STUDIES ON IRRADIATED PELOMYXA. Edward W. Daniels (Argonne National Lab., Lemont,

Ill.). Ann. N. Y. Acad. Sci. 78, 662-74(1959) June 18.

The comparative effects of x rays, γ rays, fission neutrons, and ultraviolet radiation on the giant amoeba P. illinoisensis are shown. Particular attention is given to the percentages of survival and length of life after various exposures. Major emphasis is placed upon the therapeutic value of nonirradiated protoplasm and some of its centrifuged portions following a special method of microinjection known as fusion. Whole protoplasm, as well as heavy portions of centrifuged amoebae, prevent radiation sickness and death after injection into supralethally irradiated amoebae. On the other hand, light portions of nonirradiated, centrifuged amoebae progressively lose this capacity as the centrifugal force is increased. Nuclei are not necessary components of therapeutic portions. Fission neutron as well as ultraviolet radiation bring about the inactivation of the therapeutic component in nonirradiated protoplasm that otherwise prevents death in supralethally x-irradiated amoebae. Implications of these findings are discussed. (auth)

19787

THE DIFFERENT DISTRIBUTION OF RUBIDIUM AND CESIUM IN NATURAL PLANTS. Noboru Yamagata, Toshiko Yamagata, and Shunji Matsuda (Gunma Univ., Kiriu, Japan). Bull. Chem. Soc. Japan 32, 407-14(1959) Apr.

The different distribution of rubidium and cesium in natural plants is investigated. The different nature of these elements in the biological cycle from soil to plant is discussed. (C.J.G.)

19788

A METHOD FOR EVALUATING THE EFFECTS OF IONIZING RADIATION ON MICRO-ORGANISMS. A. Lengerová. Folia Biol. (Prague) 1, 54-61(1955). (In Russian)

If a drop of a suspension of infusoria is placed in an electric field, the organisms move toward the cathode, their paths of movement lie in the horizontal levels, they do not cross, and the speed of movement can easily be compared. With a suitable number of photographic recordings it is possible to determine the average speed of movement for each tested specimen. The effects of radiation and the influence of protective substances on the speed of movement were studied on pure cultures of Tetrahymena gelei. Results are discussed. (C.H.)

19789

THE INFLUENCE OF THE SIMULTANEOUS EFFECT OF X-RAY IRRADIATION AND SOME NARCOTICS AND STIMULANTS ON THE MORTALITY OF TADPOLES. M. Praslička, J. Heloňa, J. Havelka, and J. Žižka. Folia Biol. (Prague) 1, 375-80(1955). (In Russian)

Tadpoles of Rana esculenta were selected for experiments to ascertain changes in the action of irradiation produced by certain narcotics and by strychnine. The control tadpoles were irradiated with a dose of 27,500 r, as were also tadpoles in a watery solution of one of the following substances: ether (0.1%), ethanol (2 and 2.5%), chloral hydrate (0.3%), avertine (irradiation in water for 5 mins. in 0.1% solution), strychnine (1:100,000, 1:50,000, 1:30,000). The average duration of survival of the tadpoles irradiated in the watery solution of narcotic substances is in all cases statistically and significantly prolonged in comparison with that in the case of the tadpoles irradiated in water. Strychnine in a concentration of 1:100,000, which produced signs of irritation, produced sensitivity to irradiation; in concentrations of 1:50,000 and 1:30,000, which produced inhibition, it had a protective effect, in as far as the tadpoles survived the toxic action of the strychnine. It would appear that irradiation intensifies the toxic action of avertine, ether, chloroform, and scopolamine. (auth)

19790

THE MECHANISM OF THE BIOLOGICAL ACTION OF RADIATION. F. Herčík (Czechoslovak Academy of Sciences, Brno). Folia Biol. (Prague) 2, 193-200(1956).

Reaction mechanisms involved in radiation injuries of biological materials are discussed. It is concluded that the quality of radiation damage does not depend on the radiation dose. A small dose of radiation may result in a slight deviation in nucleoprotein metabolism, which may be manifest by a permanent, hereditary change. With larger doses, disintegration of nucleoprotein takes place. While other mechanisms are also involved in radiation injuries, the author concludes that the nucleoproteins are the central axis of all the changes. (C.H.)

19791

THE PREVENTIVE AND THERAPEUTIC EFFECT OF ULTRAVIOLET RADIATIONS IN PENETRATING RADIATION INJURIES. E. G. Zhuk (Kirov Military-Medical Academy). Gigiena i Sanit. 23, No. 10, 84-6(1958) Oct. (In Russian)

Prophylactic treatments of white rats with ultraviolet radiation improved their resistance to lethal doses of γ and x radiation. The average life span of the exposed rats was prolonged 15 to 20%. Protective effects of ultraviolet rays were observed in data on peripheral blood changes, the dynamics of weight loss, and general conditions of rats suffering from acute radiation injuries. (R.V.J.)

19792

BIOLOGICAL ACTIVITY OF BONE MARROW CELLS CULTIVATED IN VITRO IN THE PRESENCE OF RADIOISOTOPES (Fe^{59}). C. Sacchetti, A. Tizianello, F. Diena, and I. Pannacciulli (Universita, Genoa). Minerva nucleare 3, 213-17(1959) June. (In Italian)

Guinea pig bone marrow was incubated in vitro with increasing amounts of radioactive iron. Fe^{59} uptake was evaluated in erythroblasts and in the cells as a whole; at the same time the functional behavior (proliferation, growing, and production of mature cells) of erythroblasts and granuloblasts of normal bone marrow, bone marrow with erythroblastic hyperplasia after venesection or phenylhydrazine, and irradiated bone marrow was investigated. Radio-iron uptake is proportional to the amount of tracer and it varies with the type of bone marrow investigated. Biological activities of hemopoietic cells appear affected even by very small radiation dosages. Granuloblastic stem is the most sensitive: 0.1 μc/ml induce a maturative arrest in 70% of the cultures. The data obtained show that in vitro utilization of Fe^{59} is a complicated process. Possible interpretations are discussed. (auth)

19793

IRRADIATION AND KIDNEY TUMORS, HISTOPATHOGENESIS OF KIDNEY TUMORS IN IRRADIATED MICE. Charles C. Berdjis (Fourth U. S. Army Medical Lab., Fort Sam Houston, Tex.). Oncologia 12, 193-202(1959).

From the histopathologic analysis of some 1000 irradiated mice it was concluded that spontaneously-occurring kidney tumors in mice are rare. Irradiation seems to be responsible for producing kidney tumors in mice (proportion 10% of the cases). Radiation-induced

kidney tumors are mostly papillary cystadenomas, "miliary type." The glomerular capsule appears to be most sensitive to the effects of irradiation. Masculinization and a lesser degree of feminization seems to confirm it. While renal tumors in man are considered to originate from the renal tubules, the irradiation-induced tumors in kidneys seem to arise from the glomerular capsule with secondary involvement of the tubules. Histopathologic changes of the glomeruli from normal to tumor formation are illustrated. (auth)

19794

THE EFFECT OF HORMONAL MILIEU VARIATION ON THE RADIATION SENSITIVITY OF THE GUERIN CARCINOMA. L. Váczy, R. Molnar, and M. Csillag (Medizinische Universitat, Budapest). Oncologia 12, 215-27(1959). (In German)

The hormonal influence in tumor radiosensitivity was examined on transplantable Guérin rat carcinoma. The experiments indicate a hormonal influence on the radiosensitivity. Estrogen treatment appeared to neutralize the radiation effect, as the survival time of those animals which were irradiated and treated with estrogen was the same as of those control animals which were not irradiated. The experiments also prove the radiosensitivity of the Guérin carcinoma. (auth)

19795

COMPARATIVE INVESTIGATION OF THE ACTION OF X-RAYS AND OF "RADIOMIMETIC" SUBSTANCES. I. QUANTITATIVE ANALYSIS OF THE EFFECTS OF X-RAYS AND OF METHYL-BIS-BETACHLOROETHYLAMINE ON THE LYMPHOCYTES OF THE LYMPHATIC GLANDS OF THE RAT. Carissimo Biagini and Pier Giuseppe Paleani Vettori (Università, Rome). Ricarca sci. 29, 1396-1401(1959) July. (In Italian)

In rats treated with x rays or methyl-bis-betachloroethylamine (HN_2) the progress of the percentage of pyknotic nuclei in their lymphatic glands was investigated as a function of time and dosage. If the animals had been previously subjected to irradiation or to an HN_2 administration, the effect of a second treatment with HN_2 is smaller than in the controls not previously treated. The dose administered with the first x-ray or HN_2 treatment must reach a threshold value if the second HN_2 treatment is to be less efficient. (auth)

19796

COMPARATIVE INVESTIGATION OF THE ACTION OF X-RAYS AND OF "RADIOMIMETIC" SUBSTANCES. II. QUANTITATIVE ANALYSIS OF THE EFFECTS OF METHYL-BIS-CHLOROETHYLAMINE (HN_2) ON THE LYMPHOCYTES OF THE LYMPHATIC SYSTEM OF RATS, WITH PRELIMINARY TREATMENT WITH HN_2 OR WITH X-RAYS. Pier Giuseppe Paleani Vettori and Carissimo Biagini (Università, Rome). Ricarca sci. 29, 1499-1504(1959) July. (In Italian)

The influence of a first x-ray or HN_2 treatment on the effect of irradiation or endoperitoneal administration of HN_2 on the pycnotic index (P.I.) in the lymph glands of rats was investigated as a function of the time intervening between the first and second treatment and of the protection imparted by chemical and physical means. The decrease in effect as previously described for HN_2 occurs only when the lymph glands are directly irradiated and only after a period of latency. The P.I., investigated as a function of HN_2 dosage in the second treatment, showed an alteration in cell population. (auth)

19797

LEUKEMOGENIE ACTIVITY OF FILTRATES FROM RADIATION-INDUCED LYMPHOID TUMORS OF MICE. Miriam Lieberman and Henry S. Kaplan (Stanford Univ., Calif.). Science 130, 387-8(1959) Aug. 14.

Cell-free filtrates of x-ray-induced lymphoid tumors of strain C57BL/Ka mice have elicited, on injection into newborn isologous hosts, a lymphoma incidence of 15 to 19 percent. In control mice of the same subline, the incidence of spontaneous lymphoma is about 1 percent. No leukemogenic activity could be detected in filtrates from thymi harvested at 2 to 32 days following completion of x-ray treatment. Activity was evident at 64 days and was perhaps somewhat greater at 128 days. Serial cell-free passage of filtrates in newborn F_1 hybrid mice resulted in a marked increase in lymphoma incidence coupled with a shortening of the median latency. Supplementary x-irradiation failed to enhance the activity of filtrates after neonatal injection. (auth)

19798

CHROMOSOMAL TRANSLOCATION IN DOMESTIC FOWL INDUCED BY X-RAYS. Earl H. Newcomer (Univ. of Connecticut, Storrs). Science 130, 393-4(1959) Aug. 14.

The cytological appearance and behavior of an x-ray-induced reciprocal translocation between the first and second chromosome of the domestic fowl is described, and its relevance to the further definition of linkage studies in the fowl is observed. (auth)

19799

EFFECTING MORPHOGENESIS OF EMBRYONIC ORGANS BY IONIZING RADIATION. I. EMBRYONIC ANOMALIES BY X-IRRADIATION OF ARABIDOPSIS THALIANA EMBRYOS IN VARIOUS DEVELOPMENT STAGES. Erna Reinholz (Max-Planck-Institut für Biophysik, Frankfurt am Main). Strahlentherapie 109, 537-53(1959) Aug. (In German)

A single irradiation with 5000 r of inflorescences of the crucifer Arabidopsis thaliana caused death or developmental anomalies of the embryos enclosed in the pods. The organ formation could be influenced at the whole developmental period between fertilization and differentiation of tissues. The sensitivity to irradiation was different at different developmental states and there were different tendencies for the formation of one or the other variant. The experimental results make it likely that not only direct damage of the tissues in the areas of increased mitotic activity but also changes of the biochemical pattern of the proembryos are responsible for the induction of development anomalies. (auth)

19800

INVESTIGATIONS ON A BIOLOGICAL RADIATION PROTECTION. XXXI. THE OPERATING MECHANISM OF 5-HYDROXYTRYPTAMINE IN RADIATION PROTECTION RESEARCH. Hanns Langendorff, Hans-Joachim Melching, and Hans-Adolf Ladner (Universität, Freiburg i. B.). Strahlentherapie 109, 554-60(1959) Aug. (In German)

The importance of 5-hydroxytryptamine for the release of a radiation protection effect in animal experiments is discussed. The protective effect of 5-hydroxytryptamine derivates was studied. Results indicate that for the release of a protection effect by 5-hydroxytryptamine the presence of free unbound 5-hydroxytryptamine is necessary. (auth)

19801
INVESTIGATIONS ON THERAPEUTIC POSSIBILITIES IN POISONING WITH RADIOACTIVE FISSION PRODUCTS. VI. AFFECTING OF THE BEHAVIOR OF RADIOSTRONTIUM BY EARTH ALKALINE SALTS. Alexander Catsch and Helga Melchinger (Heiligenberg-Instituts, Heiligenberg/Baden, Ger.). Strahlentherapie 109, 561-72(1959) Aug. (In German)

The influence of strontium, calcium, and magnesium on the deposition of radiostrontium in the skeleton of the rat was investigated. By isotopic carrier dilution no reduction of the deposition was observed after administration. The excretion of isotopically diluted radiostrontium from the skeleton experienced a weak but significant decrease compared to carrier-free radiostrontium. A tentative hypothesis is proposed which makes the increased rate of formation of apatite crystals, caused by increase of the relevant ion product, responsible for the ineffectivity of high carrier doses. The efficiency of calcium is lower compared to strontium whereas magnesium reduces the deposition of radiostrontium by 30 to 40%, provided the magnesium is applied in high doses and within a few hours after or before the incorporation of radiostrontium. A reduction of the deposition was also achieved by sodium thiosulfate. (auth)

19802
INFLUENCE OF POLYSACCHARIDE ZYMOSONE ON THE MORTALITY OF IRRADIATED MICE. Edwin Linder and Henry Isliker (Universität, Bern). Strahlentherapie 109, 584-7(1959) Aug. (In German)

After whole-body irradiation of mice with a lethal dose of x rays the mortality was significantly increased by administration of the polysaccharide zymosone after irradiation. A protective effect of small doses was not observed. (auth)

19803
EXPERIMENTAL INVESTIGATIONS ON THE EFFECT OF THE PRE-AND POST-OPERATIVE X IRRADIATION ON WOUND HEALING. Rudenz Schmid (Kantonsspitals, St. Gallen, Switzerland). Strahlentherapie 109, 609-19 (1959) Aug. (In German)

The effect of high doses of x rays (10,000 r) on wound healing after skin incisions at the chest of rats was studied on pre- and postoperative irradiation, and compared with preoperative irradiation in divided doses. There are obvious histological differences between preoperative and postoperative irradiation. A delay of wound healing was found grossly in every type of irradiation and proved histologically. The findings are summarized. (auth)

CHEMISTRY

General

19804 AECU-4322
Montefiero Hospital, New York.
THE DEVELOPMENT OF CHELATING AGENTS FOR ENHANCING THE URINARY EXCRETION OF STRONTIUM. Period covered: September 1, 1958 to September 1, 1959. Harry Kroll, Harold Jurgens, Maria Gordon, Elsie Segal, and Arthur Saunders. Sept. 2, 1959. 44p. Contract AT(30-1)-2094. $7.80(ph), $3.30(mf) OTS.

The alkaline earth stability constants for three hydroxy polyaminoacetic acids were determined. The introduction of a hydroxy group in the 2-position of 1,3-propylenediaminetetraacetic acid increased the stability of the strontium chelate and decreased that of the calcium derivative. The stability constant of the strontium chelate of trans 1,2-diaminocyclohexanetetraacetic acid was determined. The compound bis [(dicarboxymethyl)2-aminocyclohexyl] sulfide was found to form less stable calcium and strontium chelates than bis[(dicarboxymethyl)2-aminoethyl] sulfide. C-methyl polyamineacetic acids synthesized include dipropylenetriaminepentaacetic aicd, bis[(dicarboxymethyl)2-aminopropyl] ether, and bis[(dicarboxymethyl)2-aminopropyl] sulfide. Qualitative studies indicate that the calcium and strontium chelates are more stable than the unsubstituted analogs. The compounds N,N,N',N'-tetrakis(carboxymethyl) lanthionine and N,N-bis(carboxymethyl)DL-aspartic acid were synthesized. The alkaline earth chelates of these compounds are extremely stable. The effect of carboxy substituents in polyaminoacetic acids on metal chelation is discussed. Calcium and strontium chelates of bis[(dicarboxymethyl)aminoethyl] ether increased the urinary excretion of radiostrontium in rats when the isotope and chelate were administered intraperitoneally. Magnesium chloride plus the calcium chelate of bis[(dicarboxymethyl)aminoethyl] ether were also effective in promoting Sr^{85} excretion. (auth)

19805 AERE-AM-39
United Kingdom Atomic Energy Authority. Research Group. Chemistry Div., Chatham Outstation, Kent, England.
THE DETERMINATION OF SILICON IN BERYLLIUM COMPOUNDS (FLUORIDE, HYDROXIDE AND AMMONIUM FLUORBERYLLATE). E. Bowell and K. E. Heathfield. July 1959. 7p. $0.25(BIS).

After appropriate solution of the sample the silicon is determined absorptiometrically as the reduced silicomolybdic acid complex. The method is suitable for silicon contents up to 2,000 ppm. The error except in the lower ranges should not exceed ± 10% and is in part attributable to the variable silicon contents of the filter papers used for the sample and the blank determination. (auth)

19806 AERE-AM-42
United Kingdom Atomic Energy Authority. Research Group. Chemistry Div., Chatham Outstation, Kent, England.
THE DETERMINATION OF CHLORINE IN BERYLLIUM, THORIUM OR URANIUM METALS OR THEIR OXIDES. J. Walkden. June 1959. 8p. $0.25(BIS).

The sample is heated to a temperature of 1100 to 1200°C in steam. The HCl formed is collected in the condensate and the Cl determined absorptiometrically after the addition of mercuric thiocyanate and ferric alum. (auth)

19807 AERE-C/R-1042
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
SOME ASPECTS OF THE DRY CHEMISTRY OF PLUTONIUM FLUORIDES. J. K. Dawson, R. M. Elliott, R. Hurst, and A. E. Truswell. Nov. 7, 1952. Decl. July 10, 1953. 14p.

A method for the preparation of plutonium trifluoride and tetrafluoride on the milligram scale is described. The reaction of plutonium trifluoride with very dry oxygen has been studied and the free energy and heat of formation of plutonium tetrafluoride deduced from

measurements of the oxygen pressure developed by the reverse reaction. The vacuum dehydration, and decomposition of plutonium tetrafluoride has also been investigated, $2PuF_4 \cdot 5H_2O$ in vacuum at 200°C gives $PuF_4 \cdot H_2O$ and at higher temperatures the main product of the dehydration is PuF_3. Anhydrous plutonium tetrafluoride undergoes disproportionation at 900°C in vacuum to give PuF_3 and probably the more volatile PuF_5. (auth)

19808 AERE-C/R-1237

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE INFRA-RED SPECTRA AND MOLECULAR STRUCTURE OF SOME INORGANIC HEXAFLUORIDES. PART 5. CALCULATION OF FORCE CONSTANTS AND BOND LENGTHS. J. Gaunt. Aug. 13, 1953. 10p.

The force constants of the hexafluorides studied previously were calculated. It was shown that the mutual repulsion between the non-bonded fluorine atoms gives rise to an elongation of the X-F bonds, and attempts to calculate this elongation were made. A relationship between the force constants and the bond lengths was established and used to predict those bond lengths which were hitherto unknown. (auth)

19809 AERE-R-2899

United Kingdom Atomic Energy Authority. Research Group. Chemistry Div., Woolwich Outstation, England.

THE DETERMINATION OF RADIOACTIVITY DUE TO CAESIUM, STRONTIUM, BARIUM, AND CERIUM IN WATERS AND FILTERS. R. G. Osmond, M. J. Owers, C. Healy, and A. P. Mead. July 1959. 40p. $0.77 (BIS).

Methods are described for determining the fission products Sr^{89}, Sr^{90}, Cs^{137}, Ba^{140}, Ce^{141}, and Ce^{144} in rain and tapwaters and in air filter samples. Details are given of the development of the methods and of the precautions required to achieve chemical and radiochemical purity of the final sources. Special low background counting equipment is used and the lower limit of detection of any of the nuclides is about 1 $\mu\mu$c. (auth)

19810 AERE-R-2939

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

THE MICROSTRUCTURE OF PLUTONIUM DIOXIDE PREPARED BY VARIOUS METHODS. K. E. Francis and R. G. Sowden. June 1959. 23p. $1.26(BIS).

The microstructure of plutonium dioxide prepared from the nitrate, iodate, sulfate, hydroxide, and oxalate was examined. The preparation route has a marked influence on physical characteristics, especially on particle size distribution, surface area and density. The sulfate gives a powder of low particle porosity and marked resistance to crystallite growth at higher temperatures. The powder obtained from the oxalate under certain circumstances may consist of pseudomorphic particles up to 10μ in diameter, with a high internal surface which is markedly reduced during high temperature calcination. High-temperature water had no effect on the physical properties of the oxide obtained from sulfate though breakdown of pseudomorphs was observed when the oxalate preparation was tested. (auth)

19811 CF-59-8-106

Oak Ridge National Lab., Tenn.

SPECTROGRAPHIC ANALYSIS OF NORMAL HUMAN TISSUE FROM RICHMOND, VIRGINIA. I. H. Tipton, M. J. Cook, J. M. Foland, Johanna Rittner, Michael Hardwick, and K. K. McDaniel. Aug. 25, 1959. 52p. $9.30(ph), $3.60(mf) OTS.

Data are tabulated on the amounts of approximately 40 minor and trace elements in normal human tissues analyzed spectrographically. (C.H.)

19812 DMIC-Memo-29

Battelle Memorial Inst. Defense Metals Information Center, Columbus, Ohio.

NITRIDING OF TITANIUM. J. W. Holladay. Aug. 12, 1959. 13p.

A wide variation of conditions was investigated for nitriding titanium. There is substantial agreement on the optimum conditions. Variation from the optimum condition results in some penalty either in the quality of the nitride coating or in the properties of the titanium core material. Only the optimum conditions are given, with some indication of the range of conditions that have been studied. (auth)

19813 HW-25074

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

ANALYTICAL PROCEDURES FOR THE PLUTONIUM METAL FABRICATION PROCESS. VII. THE CUPFERRON EXTRACTION-COPPER SPARK METHOD. T. K. Bierlein, L. F. Kendall, and H. H. Van Tuyl. July 25, 1952. Decl. July 1, 1959. 23p. $4.80(ph), $2.70(mf) OTS.

Tri- or tetravalent plutonium is separated from impurity elements by extraction of plutonium cupferride into chloroform. The aqueous phase is evaporated along with cobalt internal standard and placed on copper electrodes which are sparked to produce the impurity spectrum. The amounts of impurities present are determined by comparison of the densities of impurity lines with standard spectra and correcting for the recovery of cobalt internal standard. (auth)

19814 HW-34501

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

CHEMICAL STABILITY OF PUREX AND URANIUM RECOVERY PROCESS SOLVENT. R. H. Moore. Mar. 2, 1955. Decl. July 15, 1959. 15p. Contract [W-31-109-Eng-52]. $3.30(ph), $2.40(mf) OTS.

The desirability of operating the Purex columns at higher temperatures, 50 to 70°C, made it necessary to obtain data on the stability of solvents at these higher temperatures. Since the present diluent will not be entirely safe at the upper temperature limit, a number of diluents with higher flash points were investigated. (J.E.D.)

19815 IGO-AM/S-159

United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.

THE VOLUMETRIC DETERMINATION OF ALUMINUM IN URANIUM–ALUMINIUM ALLOYS. Mar. 5, 1959. 7p. $0.21(BIS).

Aluminum is separated from uranium and iron by passage through a column of anion exchanger resin, and determined by titration with ethylene diamine tetraacetic acid, disodium salt, and standard zinc chloride solution. The method is intended for aluminum contents at the 3% level, but is suitable for aluminum contents up to 10% if a 10% (w/v) solution of the sample is prepared. (auth)

19816 IGO-AM/S-198

United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.

THE ABSORPTIOMETRIC DETERMINATION OF URANIUM IN MONAZITE AND THORITE ORES. May 12, 1959. 8p. $0.25(BIS).

A ground sample is fused with potassium hydroxide. The uranium is separated by use of an alumina/cellulose chromatographic column and determined spectrophotometrically using hydrogen peroxide. The method has been applied to a variety of monazites and thorites which contained not more than 0.5% uranium. Provided that the preliminary treatment is applicable, a smaller aliquot of sample solution and the use of a smaller spectrophotometric cell should permit determinations of uranium above this level. (J.E.D.)

19817 IGR-176(O/CA)

United Kingdom Atomic Energy Authority. Industrial Group. Capenhurst Works, Capenhurst, Ches., England.

RECOMMENDED LABORATORY PROCEDURE FOR THE PURIFICATION OF RECOVERED MERCURY. June 12, 1959. 7p. $0.21(BIS).

Impurities are oxidized by prolonged compressed air blowing and removed by repeated water and nitric acid washes. (auth)

19818 K-1430(Vol. I)

Oak Ridge Gaseous Diffusion Plant, Tenn.

SOME THERMODYNAMIC PROPERTIES OF FREON-114. VOLUME I. −40°F TO THE CRITICAL TEMPERATURE. Nelson H. Van Wie and Robert A. Ebel. Sept. 2, 1959. 243p. $3.50(OTS).

Recent correlations of the physical properties of dichlorotetrafluoroethane have been used to compute certain thermodynamic properties of this refrigerant. Specific volume, specific heat, enthalpy, and entropy of both the saturated and superheated vapor are tabulated over the range −40 to 294.26°F, saturated pressure (minimum) at −40°F, and a maximum entropy of ~0.22. Latent heat content, enthalpy, and density of the saturated liquid are also included. (auth)

19819 KAPL-M-OJA-1

Knolls Atomic Power Lab., Schenectady, N. Y.

THE COLORIMETRIC DETERMINATION OF VANADIUM IN NIOBIUM−VANADIUM ALLOYS. O. J. Articolo. June 26, 1959. 7p. Contract W-31-109-Eng-52. $1.80(ph), $1.80(mf) OTS.

A procedure is described for the analysis of vanadium in niobium−vanadium alloys in the range >0.2% vanadium with an accuracy of better than 3%. The method was applied to the analysis of niobium alloys in which the nominal per cent vanadium varied between 0.3 to 4.6%. The sample is dissolved in a mixture of nitric and hydrofluoric acid and then evaporated to fumes with sulfuric acid. The niobium is hydrolyzed with sulfurous acid and separated from the vanadium by filtration. Hydrogen peroxide is added to the filtrate to form a reddish brown complex with the vanadium. The optical density of the resulting solution is obtained at 450 mμ on a model B Beckman spectrophotometer. (auth)

19820 NOLC-457

Naval Ordnance Lab., Corona, Calif.

FUSED SALT VOLTAIC CELLS. An Annotated Bibliography of the Technical Literature Concerning Cell Potentials. W. C. Spindler and R. E. Panzer, comps. July 31, 1959. 41p. (NAVORD-5957).

An annotated bibliography is presented of 85 articles pertaining to electrochemical cells utilizing fused salt electrolytes, with particular application to energy-producing voltaic cells. The literature cited includes material on electrode potentials and electrode reactions in both voltaic and electrolytic cells; it does not include references to the physical and chemical properties of fused salts. (auth)

19821 NP-7844

Ohio State Univ. Research Foundation, Columbus.

THERMAL FUNCTIONS AND HEATS OF FORMATION OF SOME OF THE MAJOR VAPOR SPECIES IN THE BORON−OXYGEN−HYDROGEN SYSTEM AT ELEVATED TEMPERATURES. Technical Report No. 4. David White, Patrick N. Walsh, David E. Mann, and Armin Sommer. July 1959. 24p. RF Project 691. Contract Nonr-495(12).

The thermodynamic properties of the gaseous molecules B_2O_3, B_2O_2, HBO_2, and $(HBO_2)_3$ are discussed in the light of the results of a spectroscopic investigation of the B-O-H system. Extensive tables of thermal functions for these molecules are given. The heats of formation of these species, as well as others in the B-O-H system, are summarized, and the uncertainties discussed. These thermodynamic properties have been used to compute phase equilibriums and partial pressures of the vapor species in the oxidation of boranes at various temperatures and stoichiometric ratios. (auth)

19822 NP-7847

Fulmer Research Inst., Ltd., Stoke Poges, Bucks, England.

STUDIES AND EXPERIMENTAL INVESTIGATIONS IN THE FIELD OF MEASUREMENTS OF THE HEAT OR FREE ENERGY OF FORMATION OF THE CHLORIDES AND BROMIDES OF NIOBIUM AND TANTALUM. P. Gross, C. Hayman, D. L. Levi, and G. Wilson. June 1959. 44p. (R-115/5/23/June 1959).

The heats or free energies of formation of various chlorides and bromides of Nb and Ta were studied. The standard heat of formation established for each compound is as follows: $NbCl_5$, $\Delta H^0_{298} = -190.6$ kcal/mole; $NbBr_5$, $\Delta H^0_{298} = -132.85$ kcal/mole; $TaCl_5$, $\Delta H^0_{298} = -205.52$ kcal/mole; and $TaBr_5$, $\Delta H^0_{298} = -142.96$ kcal/mole. The total error in these values is estimated to be not greater than 0.3 kcal/mole for the pentachlorides and not greater than 0.4 kcal/mole for the pentabromides. (W.L.H.)

19823 NP-7852

Monsanto Chemical Co., Everett, Mass.

RESEARCH ON SYNTHESIS OF 1000°F. STABLE BASE FLUIDS. Quarterly Report No. 6 [for] May 1, 1959−July 31, 1959. James W. Dale, G. J. O'Neill, and Elizabeth A. McElhill. Aug. 4, 1959. 17p. Monsanto Project 2002. Contract AF33(616)-5553.

o-Phenylene phenylboronate was found to be exceptionally stable thermally with a decomposition temperature of 925 to 945°F. The stability is comparable to that of polyphenyls and is much greater than for any other boron compound tested. The stability is attributed to the cyclic structure of the compound and similar compounds of higher molecular weight and boiling point would be expected to have comparable stability. Decachlorobiphenyl was found stable to over 950°F. Tetraphenylsilane (900°F) and phenyl silicate (875°F) were found more stable than a polymer containing Si−O−Si

linkages, $Si_nO_{n-1}(OC_6H_5)_{2n+2}$ (735 to 785°F). A disilane, bis(cyclopentamethylene n-dodecyl)disilane, started to decompose at about 690°F. Triphenyl boron, pyridazine and diphenyl phthalate were also found relatively unstable. The tests on fluorine compounds in the vapor phase indicated that for high stability hydrogen should be excluded from the compound. Benzotrifluoride and 2-trifluoromethylpyridine are much less stable than perfluorocyclohexane or hexafluorobenzene. Cyanuric fluoride decomposed at about 990°F (vapor phase). Perfluorodiethylcyclohexane decomposed at 800°F which is lower than expected considering the high stability of perfluorocyclohexane. More tests of similar compounds with perfluoroalkyl substituents are needed however to determine if the lowering of stability by substituents is real. (For preceding period see NP-7745.) (auth)

19824 NP-7875

British Columbia. Univ., Vancouver.

VOLATILE FLUORO COMPOUNDS. Technical Report No. 1. R. G. Cavell, H. C. Clark, and C. J. Willis. July 1959. 34p. Project NR-052-403. Contract Nonr-2659(00).

A study of new organometallic derivatives containing the trifluoromethyl group and in particular these derivatives of the elements of periodic groups three and four is presented. A study of the physical and chemical properties of volatile transition metal fluorides is included. (W.L.H.)

19825 NP-7890

Midwest Research Inst., Kansas City, Mo.

DEVELOPMENT OF THERMALLY STABLE SILICON CONTAINING RESINS. Quarterly Progress Report No. 10 [for] March 16–June 15, 1959. L. W. Breed. July 15, 1959. 30p. Project title: RUBBER, PLASTIC, AND COMPOSITE MATERIALS. Task title: SYNTHESIS AND EVALUATION OF NEW POLYMERS. Contract AF33(616)-3675.

Research on the preparation of silicon-containing polymers which are thermally stable and more rigid at elevated temperatures is described. Subjects which have been investigated during this report period are: the synthesis and hydrolysis of difunctional monomers containing one bulky silicon-attached group; further preparation and examination of polymers containing silicon and chelated aluminum; additional work in the preparation of chelated titanium monomers for use in silicon-containing polymers; and a study of various methods of polymerization of bis silanes. (auth)

19826 ORNL-2782

Oak Ridge National Lab., Tenn.

CHEMISTRY DIVISION ANNUAL PROGRESS REPORT FOR PERIOD ENDING JUNE 20, 1959. Sept. 14, 1959. 100p. Contract W-7405-eng-26. $2.50(OTS).

Nuclear Chemistry. The longitudinal polarization of P^{32} beta rays was measured. From measurements of the radiations of Dy^{159}, an electron-capture decay scheme was proposed, and the disintegration energy was deduced. The 8-min Ga^{74} was separated from the fission products of U^{235}, and its fission yield was found to be 3.4×10^{-4}%. The energies of the two principal gamma rays in the decay of Y^{88} were measured. An energy level scheme in Xe^{136} was proposed. A decay scheme was postulated for I^{134}. Specific activity measurements were performed on long-lived Tc isolated from U fission products and from neutron-irradiated Mo. Values of 1450 ± 100 and 400 ± 100 barns, respectively, were obtained for thermal neutron cross section and the resonance integral of the 23-min Th^{233}. Resonance integrals of 85 ± 8 and 75 ± 5 barns were determined for Th^{232} and Co^{59}, respectively. Isolation and Chemical Properties of Synthetic Elements. Two different species of Tc(V), stable in concentrated HCl, were observed. Experiments on the separation of Tc are reported. Chemical Separation of Isotopes. Considerable quantities of D_2 and D_2O of low tritium content were produced. An investigation of the feasibility of enriching N and O isotopes by distilling NO was begun. The infrared spectra of the normal and N^{15} forms of N_2O_4, NO_3^-, and NOCl were examined. Raman studies were made of $Zn(ND_3)_4^{2+}$ as well as the N^{14} and N^{15} forms of N_2O_4 and NO_3^-. Radiation Chemistry. Very marked increases in catalytic activity for H_2-D_2 exchange were induced in silica gel by both gamma rays and neutrons. Electron irradiation of methane–oxygen gaseous mixtures produces only CO_2, water, and ozone. Organic Chemistry. The diphenyl-m-tolyl glycol system was examined radiochemically, and the results completely support a mechanism previously proposed for the pinacol rearrangement. The mechanism of decarbonylation of formic, benzoylformic, and triphenylacetic acids was investigated. Chemistry of Aqueous Systems. An investigation of the thermodynamic properties of HCl by emf measurement at temperatures up to 275°C is reported. The osmotic coefficients of the following salts were determined as a function of concentration at 100°C: LiCl, NaCl, KCl, CsCl, $BaCl_2$, Na_2SO_4, $MgSO_4$, and UO_2SO_4. Measurements of the standard free energies and heats were completed for the exchange of Ag^+ with Na^+ in Dowex 50 cation exchangers. Positive ΔH° and ΔS° values were observed, in contrast with the Na form of the exchanger, where heat was evolved and the entropy change was always negative. Experiments directed toward elucidation of the properties of an ion exchange resin were continued. The behavior of oxides of Zr(IV), Ti(IV), Sn(IV), Nb(V), and Ta(V) in acidic and basic media was investigated with a pressurized column at 200°C. The degree of polymerization N of UO_2Cl_2, obtained from equilibrium ultracentrifugation, was studied as a function of the hydroxyl number n. Chemistry of Corrosion. Further studies on the action of inhibitors were made with agents which cannot by themselves produce passivity. The kinetics of the anodic oxidation of crystal-bar Zr in oxygen-free sulfate solutions and of reduction of oxygen, hydrogen peroxide, and copper(II) ions at a Zr electrode were determined. Nonaqueous Systems at High Temperatures. The study of the fluorine exchange between F^{18}-labeled gaseous fluorocarbons and solid metal fluorides was extended. The degree of association of NaI to Na_2I_2 in the vapor was measured. The entropies of fusion of the alkali halides were determined calorimetrically. Chemical Physics. A preliminary value for the yields of hydrogen atoms from 0.129 mole fraction H_2SO_4 irradiated at 77°K with gamma rays was determined. The crystal structure of H_2O_2 was determined. Mass spectrometric studies of nitric oxide and nitrous oxide showed that NO^+ is formed as a result of electron impact. (For preceding period see ORNL-2584.) (W.L.H.)

19827 ORO-203

Alabama. Univ., Tuscaloosa. School of Chemistry. [FINAL REPORT]. Includes Papers: HIGH-FREQUENCY TITRIMETRY (SOME THEORETICAL ASPECTS OF COIL-TYPE CELLS). Asa Leifer, Harry W. Hamme, E. L. Grove, and James L. Kassner.

A STUDY OF THE VAPOR PHASE ABSORPTION SPECTRA OF A SERIES OF ALIPHATIC KETONES IN THE ULTRAVIOLET REGION. William Randolph Mountcastle, Jr. THE DIELECTRIC CONSTANT VALUES FOR CERTAIN ALPHA SUBSTITUTED KETONES. J. L. Randall, E. L. Grove, and James L. Kassner. A COMPARISON OF THE ALKALI METHOXIDES IN THE HIGH-FREQUENCY TITRATION OF ACIDS IN DIMETHYLFORMAMIDE. S. F. Ting, E. L. Grove, and James L. Kassner. [1959]. 49p. Contract [AT(40-1)-1354]. $7.80(ph), $3.30(mf) OTS.

The H-F conductance and susceptance were determined for coil-type vessels over a range of frequencies from 2 to 30 mc. The ultraviolet absorption spectra of organic compounds in the vapor phase were determined, and a maximum was assigned to each compound. The dielectric constant values for five alpha substituted ketones at 25°C are reported. A series of acids in dimethylformamide was titrated with the alkali methoxides by the high-frequency and conductance methods. The titration curves by these two methods were very similar in shape and also very similar to the curves for the corresponding type of acid in aqueous solution. (W.L.H.)

19828 PA-TR-2316

Picatinny Arsenal. Samuel Feltman Ammunition Labs., Dover, N. J.

BEHAVIOR OF ORGANIC NITRO COMPOUNDS IN LIQUID SCINTILLATION COUNTING SYSTEMS. Cecil White and Samuel Helf. May 1956. 17p. DA Project No. 559-04-001.

A study was made of the feasibility of using liquid scintillation techniques for the radioassay of C^{14}-labelled organic nitro compounds. The results indicate that small quantities of radioactive nitro compounds, sufficient for tracer or analytical application, can be counted in liquid phosphor systems with relatively high efficiencies. The advantages of this technique for the radioassay of explosive and/or volatile materials make it far superior to any other counting method. A general theoretical treatment of the liquid scintillation process is included. Factors influencing counting rates, such as the phenomena of light absorption and the action of wavelength shifters, are discussed. (auth)

19829 RDB(C)/TN-118

United Kingdom Atomic Energy Authority. Industrial Group. Culcheth Labs., Culcheth, Lancs, England.

THE EXTRACTION OF VANADIUM BY CHLORINATION AND HYDROGEN REDUCTION. J. S. Broadley and C. Tyzack. Mar. 3, 1955. 32p.

It has been shown that ferrovanadium can be burned in gaseous chlorine to produce a mixture consisting essentially of volatile chlorides. Vanadium tetrachloride is a liquid at room temperature (B.P. 152°C) and may be almost completely separated from the ferric chloride during chlorination by the use of a suitable trap maintained above the boiling point of VCl_4, and below the melting point of $FeCl_3$. The production of vanadium powder may then proceed by two alternative methods: fractional distillation of the crude VCl_4 to produce pure VCl_4, followed by reduction with hydrogen to produce VCl_2 at 550 to 600°C, and hydrogen reduction of VCl_2 at 1000°C to produce metal; and decomposition of VCl_4 by refluxing under argon to produce VCl_3, followed by pumping to remove any volatile impurities. The trichloride is then directly reduced with hydrogen to the metal. (auth)

19830 SCS-M-55

Gt. Brit. Springfields Works, Springfields, Lancs, England.

THE DETERMINATION OF ALUMINIUM IN MOULD LININGS, CALCIUM FLUORIDE, FILTER PRESS CAKE AND REACTION SLAGS. Feb. 16, 1950. 4p.

Fluorine is removed with perchloric acid and the aluminum precipitated as hydroxide. The precipitate is dissolved in acid and the aluminum re-precipitated in the presence of cyanide and tartrate ions, as the oxidate, which is estimated gravimetrically. The method is suitable for aluminum concentrations of greater than 1%. (auth)

19831 SCS-R-26

Gt. Brit. Springfields Works, Springfields, Lancs, England.

THE DETERMINATION OF PEROXIDES IN ETHER AND ETHEREAL URANYL NITRATE SOLUTION. F. J. Armson, R. E. Worthington, N. T. Cunningham, and D. Swallow. Mar. 23, 1949. 10p.

A colorimetric method for the estimation of peroxides in ether, which is both sensitive and rapid, was developed. The method has also been used for the estimation of peroxides in ethereal uranyl nitrate solution. (auth)

19832 TID-5028

Columbia Univ., New York.

EXCHANGE REACTIONS BETWEEN HEAVY WATER AND SULFUR COMPOUNDS AND THE ASSOCIATED ISOTOPIC ANALYSES. Isidor Kirshenbaum. May 25, 1951. Decl. Mar. 7, 1957. 53p. $9.30(ph), $3.60(mf) OTS.

This report was originally submitted for publication as a part of NNES-III-4A.

Data concerning the exchange reactions between D_2O and sulfides have been collected from all available sources. Calculated equilibrium constants for the reactions involving H_2S and D_2O are presented. Experimental determinations of the equilibrium constants for the reaction $HDS(g) + H_2O(liq) \rightleftharpoons HDO(liq) + H_2S(g)$ by various investigators are described, and the results are compared with the calculations. Calculated and observed results agree within the estimated uncertainty, but the calculated values are at all times too low by about 0.13 units. Equilibrium data for the exchange between isopropyl mercaptan and heavy water are presented, and the experimental procedure by which the data were obtained is described. The D content of H_2S was determined by decomposition of the sample and mass-spectrometric analysis of the resulting H. A method described for determination of D in H_2O involved equilibration of the sample with H_2S and analysis of the H_2S. (D.E.B.)

19833 UCRL-8787

California. Univ., Berkeley. Lawrence Radiation Lab.

SOLUTION OF MULTISTAGE SEPARATION PROBLEMS BY USING DIGITAL COMPUTERS (thesis). John H. Duffin. Aug. 1959. 266p. Contract W-7405-eng-48. $4.00(OTS).

Methods of solving various problems in multistage separation operations are presented. These methods are illustrated by solving specific problems using both medium (IBM 650) and large (IBM 701) digital computers. Separations by distillation normally encountered in the petroleum and chemical industries are covered in detail from the initial considerations of variable analysis to the final convergent solution of a given problem.

Various methods of attacking a problem are presented and combinations of these methods that produce convergent solutions are suggested and illustrated. By means of appropriate equations, an operating unit is simulated on a computer and its behavior is studied as a steady-state or convergent solution is approached. Problems in distillation occur where an infinite rather than a discrete mixture is used, and methods of attack and illustrations are given for problems of this type. By using these methods it is possible to simulate such complex industrial units as crude-oil distillation columns. Nonideal equilibrium problems are also covered; methods of attack are presented as well as illustrations for a specific problem. Since methods developed for distillation operations should apply, with appropriate modifications, to any multistage process, liquid-liquid extraction is considered finally. A method of attack for problems of this type is developed and solutions of problems are given. (auth)

19834 WAPD-CTA(GLA)-162-1(Rev.3)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
THE SPECTROCHEMICAL DETERMINATION OF IMPURITIES IN ZIRCONIUM AND ZIRCALOY USING THE SILVER CHLORIDE CARRIER TECHNIQUE. R. F. Farrell, R. M. Jacobs, and N. E. Gordon. June 22, 1959. 9p. $1.80(ph), $1.80(mf) OTS.

All samples are ignited in a muffle furnace at 900°C prior to analysis. The sample oxides are mixed with a silver chloride carrier, charged into Scribner-Mullin type sample electrodes and exposed using d-c arc excitation. The spectra are recorded and measured using conventional spectrochemical practices. The measured transmittances for the spectral lines are converted to relative intensities which are referred to analytical curves to obtain the elemental concentrations. The method is applicable to the analysis of metal samples which have been removed from ingots, strips, bars, or other shapes and which can be converted readily to the oxide. (auth)

19835 WAPD-CTA(GLA)-162-7
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
THE SPECTROGRAPHIC DETERMINATION OF IMPURITIES IN ZIRCONIUM AND ZIRCALOY USING A CHROMIUM INTERNAL STANDARD. J. F. Frain, J. R. Ryan, and R. M. Jacobs. June 19, 1958. 6p. $1.80(ph), $1.80(mf) OTS.

The determination of four impurity elements (Co, Pb, Mo, and Ti) in a zirconium oxide matrix is described. The method is applicable to the analysis of metal samples which have been removed from ingots, strips, bars, or other shapes and which can be converted readily to the oxide. Synthetic standards containing the appropriate alloying constituents must be used for the analysis of Zircaloys. Metal samples are converted to the oxide in a muffle furnace, and a one gram portion of the oxide is mixed with 100 mg of chromic oxide. The mixture is pressed into the sample electrode and excited in the d-c arc. Then the spectra are recorded photographically, measured photometrically, and the calculated relative intensity ratios referred to the appropriate analytical curves to determine the elemental concentrations. (auth)

19836 WAPD-CTA(GLA)-592(Rev. 1)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
THE DETERMINATION OF OXYGEN AS AN IMPURITY IN ZIRCONIUM AND ZIRCALOY. P. Elbling and G. W. Goward. July 13, 1959. 12p. $3.30(ph), $2.40(mf) OTS.

The metal sample is reacted with carbon in molten platinum in a graphite crucible. Carbon reacts with the oxides in the sample to form carbon monoxide, which is swept out of the reaction tube with a stream of purified argon. Iodine pentoxide oxidizes the carbon monoxide to carbon dioxide, which is absorbed by a dilute sodium hydroxide solution. The amount of oxygen present in the sample is determined by measuring the change in conductance of the absorbing solution and comparing this change against that of a standard curve prepared by the analysis of known amounts of stoichiometric metal oxides such as silver, uranium, niobium, or zirconium oxides. The method covers the determination of oxygen in zirconium and Zircaloy. The range is from 50 ppm (1 g sample) to 7000 ppm (0.1 g sample). (auth)

19837 WAPD-M(GLA)-701-1(Rev. 2)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
THE DETERMINATION OF THE PRIMARY IMPURITIES IN HAFNIUM BY EMISSION SPECTROGRAPHIC ANALYSIS. J. F. Frain, J. R. Ryan, and R. M. Jacobs. Aug. 17, 1959. 11p. $3.30(ph), $2.40(mf) OTS.

A procedure is described for the determination of fourteen impurity elements in hafnium metal which has been converted to the oxide in a muffle furnace. A 0.5 gram portion of the oxide is mixed with 75 mg of a buffer. This mixture is pressed into the sample electrode, then excited with the d-c arc. The spectra are recorded photographically, measured photometrically, and the calculated intensity ratios referred to the appropriate analytical curves to determine the elemental concentrations. (J.E.D.)

19838 Y-1259
Union Carbide Nuclear Co. Y-12 Plant, Oak Ridge, Tenn.
THE SPECTROGRAPHIC DETECTION OF TRACE IMPURITIES IN BERYLLIUM OXIDE. Interim Report. O. P. Killeen. Aug. 19, 1959. 12p. Contract W-7405-eng-26. $3.30(ph), $2.40(mf) OTS.

Tentative methods are reported for the spectrographic determination of trace impurities in beryllium oxide. The detected elements include the rare earths erbium, thulium, europium, dysprosium, gadolinium, and samarium. The common elements cobalt, gold, iron, boron, silicon, manganese, lead, chromium, aluminum, calcium, yttrium, palladium, copper, indium, cadmium, silver, titanium, rhodium, nickel, and lithium were also detected. The observed detection limit for each element is reported. (auth)

19839 AAEC/E-29
A NEW ION EXCHANGE METHOD FOR ENRICHMENT OF URANIUM AND THE DETERMINATION OF URANIUM IN SOLID SAMPLES. J. Korkisch, A. Farag, and F. Hecht. Translated by H. M. J. Meyer from Mikrochim. Acta 3, 415-25(1958). 11p.

A simple, rapid, and quantitative ion exchange method was developed, which permits the separation of microgram as well as milligram quantities of uranium as a negatively charged ascorbate complex, from a large number of cations and anions by means of the strongly basic anion exchanger "Amberlite IRA-400" (ascorbate). This method is applicable following ether extraction or it may be applied directly, and because of the extremely high capacity of the ion exchanger used for the uranyl ascorbate complex, it is possible to determine uranium in materials whose uranium content is 0.0001 to 0.1% higher. (auth)

19840 CEA-tr-A-352

LES CONSTANTES CRITIQUES DE L'ACIDE FLUORHYDRIQUE. (The Critical Constants of Hydrofluoric Acid.) E. U. Franck and W. Spalthoff. Translated into French from Z. physik. Chem. (Frankfurt) 8, 255-7 (1956). 5p.

In a high-pressure calorimeter the compressibility and specific heat of hydrofluoric acid were measured up to 300°C and 300 kg/cm^2. The variation of the equilibrium densities of the vapor and liquid was determined as a function of temperature. The conductivity was found to be 7.4×10^{-4} ohm^{-1} cm^{-1} at 0°C. The critical constants were determined to be $t_c = 188 \pm 3$°C, $p_c = 66.2 \pm 3.5$ kg/cm^2, and $\rho_c = 0.29 \pm 0.03$ g/cm^3. (J.S.R.)

19841 CEA-tr-A-575

INFLUENCE DE LA CHARGE EN Cu, Ni ET Co DES COLONNES ÉCHANGEUSES SUR LA SEPARATION D'UN MÉLANGE Pr/Nd LORS D'UNE ÉBULLITION AVEC LE TRILON A. (Influence of the Cu, Ni, and Co Charge of Exchange Columns on the Separation of a Pr/Nd Mixture During Boiling with Trilon A.) G. Weidmann and G. Liebold. Translated into French by B. Moreau from Angew. Chem. 69, 753(1957). 6p.

The effects of the charging of ion exchangers with Cu, Ni, or Co on the separation of praseodymium and neodymium were investigated. In the studies Trilon A was used as eluant. A spectral analytical procedure was employed to evaluate the fractions separated. The results showed that the separations are improved in passing from copper-charged to nickel-charged to cobalt-charged exchangers. (J.S.R.)

19842 CEA-tr-R-314

ANALYSE ISOTOPIQUE DES ÉLÉMENTS ALCALINS À L'AIDE D'UN ÉMETTEUR SYNTHÉTIQUE D'IONS À BASE D'ALUMINO. (Isotopic Analysis of Alkaline Elements with the Aid of a Synthetic Ion Emitter with an Alumina Base.) G. M. Panchenkov, P. A. Akishin (Akichine), N. N. Vasilev (Wasiljev), O. T. Nikitin (Nikitine), and S. D. Moiseev (Moisseev). Translated into French from Zhur. Fiz. Khim. 30, 1380-4(1956). 21p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 11, as abstract No. 1230.

19843 CEA-tr-R-653

DISSOLUTION ANODIQUE DES MÉTAUX DANS LES SELS FONDUS. II. BÉRYLLIUM. (Anodic Dissolution of Metals in Fused Salts. II. Beryllium.) M. V. Smirnov and N. Ya. Chukreev (Tchoukreev). Translated into French by B. de Trezvinsky from Zhur. Fiz. Khim. 32, 2165-73(1958). 21p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 2788.

19844 CEA-tr-R-659

ETUDE DE LA RÉACTION DE FORMATION DE L'HYDROXYDE DE ZIRCONIUM. (Study of the Formation Reaction of Zirconium Hydroxide). I. V. Tananev and M. Ya. (Ia.) Bokmel'der. Translated into French from Zhur. Neorg. Khim. 3, 1273-80(1958). 19p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 13736.

19845 CEA-tr-R-670

TABLEAU METALLOCHIMIQUE DES ÉLÉMENTS. (Metallochemical Tables of the Elements.) I. I. Kornilov. Translated into French from Doklady Akad. Nauk S.S.S.R. 114, 106-9(1957). 11p.

A metallochemical grouping of the elements which arranges the elements on the basis of their ability to form different types of metallic compounds is presented. The family of metals is divided to show those elements which form solid homogeneous solutions, limited solid solutions with metallic compounds, metallic compounds without solid solution, compounds of the ionic type, and a group of elements which do not interact with the metals of the family occupying the central portion of the periodic system. (J.S.R.)

19846 CEA-tr-R-679

SOLUBILITÉ DES OXYDES METALLIQUES DANS LE MÉTAPHOSPHATE ET LE PYROPHOSPHATE DE SODIUM FONDUS. (Solubility of Metallic Oxides in Fused Sodium Metaphosphate and Pyrophosphate.) V. N. Andreeva. Translated into French from Ukrain. Khim. Zhur. 24, 23-8(1958). 16p.

The isothermal saturation method was used to study the solubility of Sb_2O_3, MoO_3, PbO, Bi_2O_3, CuO, ZnO, NiO, WO_3, CdO, Fe_2O_3, and TiO_2 in sodium metaphosphate and sodium pyrophosphate at 720 and 1000°C, respectively. In the fused metaphosphate, antimony oxides are dissolved in all proportions. The solubility of the oxides is greatest when the difference between the fusion temperatures of the oxide and the metaphosphate is smallest. The solubility of metallic oxides in fused metaphosphate in numerous cases deviates from the Schroeder equation, which indicates that there is a strong interaction between the components of the fused material. It is shown that there is no formation of orthophosphates. An hypothesis was proposed, according to which there is formation of compounds of the type $(RO)_m(Na_6P_8O_{18})_n$. The solubility of the oxides in the pyrophosphate was studied qualitatively (with the exception of TiO_2 and ZnO) since the high viscosity of the fused material does not allow a separation of the phases. The solubility of MoO_3 and WO_3 is very high in fused pyrophosphate and differs sharply from the solubility of the other oxides. (tr-auth)

19847 CEA-tr-R-695

FORMATION DE COMPLEXES DE CERIUM AVEC LES IONS OXALATE ET ACETATE. II. SEPARATION DU CERIUM A PARTIR D'UNE SOLUTION NITRIQUE. (Formation of Cerium Complexes with Oxalate and Acetate Ions. II. Recovery of Cerium from Nitric Acid.) N. S. Vagina (Vaguina). Translated into French by B. Vinogradoff from Zhur. Neorg. Khim. 3, 1366-9(1958). 10p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 13813.

19848 CEA-tr-R-701

ETUDE DE L'EXTRACTION DU RUTHENIUM À PARTIR DE SOLUTIONS NITRIQUES PAR DES SOLVANTS ORGANIQUES. (Study of the Extraction of Ruthenium from Nitric Solutions with Organic Solvents.) V. D. Nikolskii (Nikolsky) and V. C. Schmidt. Translated into French by [?] Kotlarov and B. de Trezvinsky from Zhur. Neorg. Khim. 2, 2746-51(1957). 19p.

The extraction of ruthenium peroxide from the tetravalent ruthenium nitrate and of ruthenium nitrosonitrates in nitric solution was examined using diethyl ether, tributyl phosphate in hydrogenated kerosene, and kerosene as the solvent. The results showed that only the nitrosonitrates are extractable in significant quan-

tities. RuO_4 is instable in the organic phase. The behavior of the ruthenium found in a nitrosonitrate solution is analogous to the behavior of the radioruthenium found in nitric solutions of irradiated uranium. (J.S.R.)

19849 CEA-tr-X-66
LE TITRAGE COMPLÉXOMÉTRIQUE (CHÉLATOMÉTRIE). L'ORANGE DE XYLÉNOL, COMME NOUVEL INDICATEUR SPÉCIFIQUE. (Complexometric Titration (Chelatometry). Xylenol Orange as a New Specific Indicator.) Jiri Körbl, Rudolf Pribil, and Antonin Emr. Translated into French from Chem. listy 50, 1440-4 (1956). 11p.

The coloring reactions of 3,3'-bis-(dicarboxydimethyliminomethyl)-o-cresolsulfonaphthalein (xylenol orange) was studied with a series of cations. The compound has remarkable properties as a complexometric indicator in acid media. The complexometric determination of Bi, Th, Sc, Pb, Zn, and Cd with this indicator is described. (tr-auth)

19850 CEA-tr-X-128
DOSAGE DU COBALT EN QUANTITE EXTREMEMENT FAIBLE AU MOYEN DE L'HYDROXYDE D'ALUMINIUM COMME ENTRAINEUR. (Determination of Cobalt in Extremely Low Quantities by Means of Aluminum Hydroxide as Carrier.) Teruc Imai and Kunio Seto. Translated into French by E. Hara from Bunseki Kagaku 7, 4-8(1958). 17p.

The efficiency of the coprecipitation process for the determination of small quantities of cobalt was investigated. The entrainment was studied as a function of temperature, pH, and digestion time, using aluminum hydroxide as the entrainer and sodium hydroxide or ammonia as the precipitating reagent. The best results were obtained in the utilization of NaOH and aluminum hydroxide at a pH between 7.4 and 9.0 with a digestion time of 15 min at a temperature of 30°C. The determination of the cobalt was then made by measurement of the absorption of the complex salt of nitroso-R-cobalt. (tr-auth)

19851 CEA-tr-X-130
ETUDE DE L'ÉQUILIBRE BINAIRE ENTRE L'HYDROGÈNE ET SES ISOTOPES. (Study of the Binary Equilibrium Between Hydrogen and Its Isotopes.) Roberto Trevigno Arizpe (Aripze). Translated into French from a report of the Comisión Nacional de Energía Nuclear, Mexico (City). 14p.

The procedure used to determine, from the differential equations of equilibrium, the equilibrium curves for the binary mixtures H_2-HD and H_2-D_2 is reported. (tr-auth)

19852 CEA-tr-X-136
MÉTHODE DE DÉCOMPOSITION PAR LE ZINC DE L'EAU À FAIBLE TENEUR EN DEUTÉRIUM. L'ANALYSE PAR SPECTROMÉTRIE DE MASSE. (Method for the Zinc Decomposition of Water with Low Deuterium Concentration. Analysis by Mass Spectrometry.) Ito Mizuike. Translated into French by S. S. Minn from Bunseki Kagaku 6, 385-9(1957). 10p.

The zinc decomposition of water is often used for the determination of the deuterium concentration. However, the method has the disadvantage of requiring delicate manipulation of the apparatus. Two apparatuses often used in this determination were tested to determine the accuracy obtainable and the ease of operation. It was shown that the apparatus either gave low results or the manipulation was difficult. A new apparatus is then described which is simple to operate and has a very brief decomposition time. The results obtained are accurate and precise. (J.S.R.)

19853 CF-58-5-108
PREPARATION OF ION EXCHANGE MEDIA BY SURFACE CHARGE REVERSAL OF SILICA GEL. Hans Kautsky and Hermann Wesslau. Translated by C. E. Schilling (Oak Ridge National Lab.) from Z. Naturforsch. 9b, 569-70(1954). 4p. $1.80(ph), $1.80(mf) OTS.

Conversion of an absorbent, silica gel, to an ion-exchange material of high capacity is described. This material would presumably be more radiation resistant than organic type exchangers. Thorium ion was used for creation of an anion-exchange material, phosphate ion for a cation—exchange material. Some application of this type material, or of the basic principles involved, appear quite possible in nuclear chemical processing. (auth)

19854 NP-tr-288
THE EQUILIBRIUM $H_2SO_4 + HF \rightleftharpoons HSO_3F + H_2O$ AND THE EFFECT OF STRONG ACIDS THEREON. Willy Lange. Translated by R. Todd (U.K.A.E.A. Atomic Energy Research Establishment) from Z. anorg. u. allgem. Chem. 215, 321(1933). 19p. $3.30(ph), $2.40(mf) JCL.

The equilibrium $H_2SO_4 + HF \rightleftharpoons HSO_3F + H_2O$ was investigated. As increasing quantities of aqueous HF are added to the H_2SO_4, the HSO_3F formed increases at first, then rapidly decreases, finally falling to zero. Foreign strong acids affect the equilibrium by the formation of hydrates. The HSO_3F concentration falls with the addition of water at a rate greater than that predicted by the law of mass action. (J.R.D.)

19855 NP-tr-289
THE ABSORPTION OF IODINE VAPOUR BY ACTIVATED CARBON AND SILICA GEL. P. Demougin. Translated by J. B. Sykes (U.K.A.E.A. Atomic Energy Research Establishment from Compt. rend. 200, 662-5 (1935). 5p. $1.80(ph), $1.80(mf) JCL.

An investigation was made to determine whether there is a discontinuity in the adsorption of iodine vapor on passing from temperature at which iodine is solid to those at which it is liquid. Various activated carbons and silica gel were used as the adsorbent. Data are presented on the quantity iodine adsorbed (mg per g) above and below the melting point for activated carbon and silica gel. (W.L.H.)

19856 SCL-T-269
ELECTROCONDUCTIVITY OF CRYSTALS IN POLYCYCLIC COMPOUNDS AND OTHER ORGANIC INSULATORS. (Elektroprovodnost' Kristallov Politsiklicheskikh Soedinenii i Drugikh Organicheskikh Izol'atorov (I). N. V. Ril'. Translated by Marcel I. Weinreich (Sandia Corp.) from Zhur. Fiz. Khim. 29, 959-74(1955). 5p. $1.80(ph), $1.80(mf) JCL or LC.

Solid paraffin having a conductivity not above 10^{-19} in fields of low intensity was found to produce an excellent electric conductivity when melted. Inhomogeneity connected with the microcrystalline structure of the material is used to explain the poor conductivity of the paraffin in the solid state. (C.J.G.)

19857
PHYSICAL PROPERTIES OF ISOTOPIC FORMS OF AZEOTROPIC SYSTEMS FORMED FROM ACETIC ACID AND SOME TERTIARY AMINES. K. E. Holmberg (AB

Atomenergi, Stockholm). Acta Chem. Scand. 13, 717-21 (1959).

Azeotropes of CH_3COOH and CH_3COOD with pyridine, trimethylamine, and triethylamine have been prepared. The boiling point differences between the H and D forms of the azeotropes are larger than those between the isotopic forms of pure acetic acid. The composition and some physical properties of the azeotropes have been determined. Upon distillation of the azeotropes, there is some separation of the nitrogen isotopes and, possibly, also of the carbon and oxygen isotopes of the carboxyl group in the acetic acid. (auth)

19858

INTERNAL ELECTROLYSIS-COULOMETRIC METHOD FOR DETERMINATION OF SMALL QUANTITIES OF OXYGEN. APPLICATION TO INDIVIDUAL SAMPLES. William G. Knapp (Argonne National Lab., Lemont, Ill.). Anal Chem. 31, 1463-7(1959) Sept.

A method that is satisfactory for use with gases and/or liquids depends on the chemical reaction between oxygen and cuprous ions and the electroreduction of the cupric ions so formed to the cuprous state. Cupric ions in cuprous ammonium chloride reagent solution are electroreduced at the platinum cathode of a platinum–copper internal electrolysis cell. Conventional coulometric procedures are then used for the integration of the electrical current generated. This current is a linear function of the oxygen chemically absorbed by the oxygen–cuprous ion reaction, and, therefore, is a function of oxygen introduced to a reaction-analysis cell. High sensitivity and good linearity over a wide range of oxygen concentrations are important features. (auth)

19859

CONTROLLED-POTENTIAL AND DERIVATIVE POLAROGRAPH. M. T. Kelley, H. C. Jones, and D. J. Fisher (Oak Ridge National Lab., Tenn.). Anal. Chem. 31, 1475-85(1959) Sept.

Controlled-potential polarography has been exploited in the versatile controlled-potential and derivative polarograph. An amplifier continuously forces the potential of the polarized electrode with respect to the reference electrode to equal that of the linearly increasing control potential independently of circuit and of cell resistances. Controlled-potential polarography is especially suitable for high resistance media or for high current polarography in aqueous media where polarograms on ordinary instruments suffer distortion, because of iR drop in the electrolyte. The polarograph can be used for the analysis of irreversible and reversible species at very low concentrations. It is possible to record the instantaneous currents, the successive peak currents, the successive average currents, or the time derivative of the polarographic wave as a function of the potential of the polarized electrode with respect to the solution. Regular and derivative polarograms are presented that illustrate the advantage of controlled-potential over conventional polarography. (auth)

19860

SPECTROPHOTOMETRIC DETERMINATION OF RHODIUM IN URANIUM–RHODIUM ALLOYS. Ross D. Gardner and Alvin D. Hues (Los Alamos Scientific Lab., N. Mex.). Anal. Chem. 31, 1488-9(1959) Sept.

Rhodium in uranium–rhodium alloys can be determined without separation by measuring the absorbance at 520 mμ of the red color formed by the addition of stannous chloride in hydrochloric acid. The procedure is rapid and only a few metals interfere at concentrations equal to or less than that of the rhodium. One hundred determinations on 0.02 to 0.2 mg. of rhodium in the presence of 10 mg. of uranium showed a relative standard deviation for individual values of 0.8%. (auth)

19861

DETERMINATION OF RADIOACTIVE STRONTIUM. A. S. Goldin, R. J. Velten, and G. W. Frishkorn (Robert A. Taft Sanitary Engineering Center, Cincinnati). Anal. Chem. 31, 1490-2(1959) Sept.

The radioactive isotopes strontium-89 and strontium-90 are determined in a wide variety of environmental samples. Strontium-90 is determined by beta-counting the daughter activity, yttrium-90, after extraction into 2-thenoyltrifluoroacetone reagent. Total radioactive strontium is determined by beta-counting a strontium carbonate precipitate. The method includes procedures for treating different types of material and removing common interferences. (auth)

19862

ANALYSIS OF THIN METAL FILMS BY NEUTRON ACTIVATION. Barbara A. Thompson (General Electric Co., Schenectady, N. Y.). Anal. Chem. 31, 1492-5(1959) Sept.

Gamma spectrometric and radiochemical methods previously used to measure trace impurities in very pure materials have been successfully applied to the analysis of very thin metal films deposited on glass. The sample weight is approximately 50 γ and conventional analytical methods can measure only those impurities present at relatively high concentrations. Methods are described for the quantitative determination of 11 elements on a single sample. Additional elements can be determined by modifying the chemical separation schemes. (auth)

19863

THERMOMETRIC TITRATION OF ACIDS IN THE PRESENCE OF HYDROLYZABLE CATIONS. F. J. Miller and P. F. Thomason (Oak Ridge National Lab., Tenn.). Anal Chem. 31, 1498-1500(1959) Sept.

A thermometric titration method is presented for determining acid in aqueous solutions of zirconyl ion in hydrofluoric acid, uranyl ion in sulfuric acid, uranyl and copper(II) ions in sulfuric acid, thorium(IV) ion in nitric acid, and uranyl ion in nitric acid. This "free acid" is determined by titrating the test solution with a standard solution of a base and recording the change in temperature during the titration. Temperature, as detected by a thermistor, is plotted automatically by a recording potentiometer vs. volume of titrant added. The end point of the titration is obtained by extrapolating the straight-line portions of the curve to their point of intersection. Milliequivalent quantities of free acid can be determined. For 0.1 meq., the relative standard error is ±1 to ±2% at the 95% confidence level; for 0.01 meq., it increases to about ±5%. (auth)

19864

DETERMINATION OF TRACE IMPURITIES IN ZIRCONIUM METAL BY A POINT-TO-PLANE SPECTROCHEMICAL PROCEDURE. Raymond F. Farrell, G. Jane Harter, and Ralph M. Jacobs (Westinghouse Electric Corp., Pittsburgh). Anal. Chem. 31, 1550-4 (1959) Sept.

Direct excitation of zirconium metal for the determination of aluminum, boron, cadmium, cobalt, chromium,

copper, hafnium, iron, magnesium, manganese, molybdenum, nickel, lead, silicon, titanium, vanadium, and tungsten in the parts per million range is described. The required spectral sensitivity and reproducibility are obtained by exciting the sample with an ignited alternating current arc. Compared to other applicable methods, the time for analysis and the opportunity for sample contamination are considerably reduced. Standard spectrochemical procedures are used for recording and computing results. With some changes in analytical lines and with adequate solid standards, the method can be extended to determination of impurities and alloying elements in Zircaloy. (auth)

19865

ANALYSIS BY PHOSPHOR POISONING. Arthur Bradley and Norma V. Sutton (Associated Nucleonics, Inc., Garden City, N. Y.). Anal. Chem. 31, 1554-8 (1959) Sept.

The luminescence efficiency of a type of cadmium sulfide phosphor was reduced by reaction with traces of copper, silver, mercury, and platinum salts in solution. There is evidence that reproducible light attenuation resulted from the accumulation of an opaque surface layer of poison element by substitution. The data may be presented as a calibration curve for a new method of quantitative analysis. (auth)

19866

SEPARATION AND DETERMINATION OF MICROGRAM AMOUNTS OF SULFUR. R. P. Larsen, L. E. Ross, and N. M. Ingber (Argonne National Lab., Lemont, Ill.). Anal. Chem. 31, 1596-7(1959) Sept.

A method has been devised for the determination of parts per million of sulfur in uranium trioxide, sodium zirconium fluoride, and hydrofluoric acid. Sulfur trioxide evolved by fusion with vanadium pentoxide is reduced over copper at 950° C to the dioxide, which is absorbed in sodium tetrachloromercurate and determined spectrophotometrically with pararosaniline and formaldehyde. The coefficient of variation for samples containing 5 to 10 γ of sulfur is 5. (auth)

19867

COLORIMETRIC DETERMINATION OF HYDROGEN DISSOLVED IN WATER. Richard H. Robinson and Dwight B. Conklin (Westinghouse Electric Corp., Pittsburgh). Anal. Chem. 31, 1598-9(1959) Sept.

An application of the Stahlberg-Isoniemi method to determine hydrogen dissolved in water used to test nuclear reactor components was performed. It was found that heat speeded the hydrogen–permanganate reaction. A buffer of monosodium hydrogen phosphate was added to stabilize pH values of specimen waters. The method was used for determinations of hydrogen content in pure water systems adjusted to contain between 5 and 50 cc of hydrogen per kilogram of water on a daily routine basis. Standard deviations from the mean of multiple determinations on the same system was ±5%. (C.J.G.)

19868

CHRYSTALLOGRAPHIC DATA: GROWTH AND CRYSTAL STRUCTURE OF SINGLE CRYSTALS OF $Pr(NO_3)_3.6H_2O$. J. W. Richardson, Q. W. Choi, F. Vratny, and J. M. Honig (Purdue Univ., Lafayette, Ind.). Anal Chem. 31, 1599-1600(1959) Sept.

Single crystals of the material were grown by dissolving high-purity Pr_6O_{11} in hydrochloric acid solution, subsequent evaporation to dryness, and treatment with nitric acid. Upon evaporation to dryness a single crystal of $Pr(NO_3)_3.6H_2O$ with dimensions 2 × 1.5 × 0.5 cm was grown. Zero-level Weissenberg data show the lattice to be monoclinic and assumed primitive. Cell constants from this data were obtained. (C.J.G.)

19869

DETERMINATION OF NITROGEN IN URANIUM NITRIDES. Joan Lathouse, F. E. Huber, Jr., and D. L. Chase (Battelle Memorial Inst., Columbus, Ohio). Anal. Chem. 31, 1606-7(1959) Sept.

Several digestion methods were tried, using a sample weight of approximately 100 mg. In the recommended method the digestion mixture consisted of 1 to 1 hydrochloric acid with additions of copper selenate and hydrofluosilicic acid. Acceptable results were obtained on both UN and U_2N_3. Apparatus and reagents used and procedures to be followed are given. (C.J.G.)

19870

THE DETERMINATION OF BORON IN PLAIN-CARBON AND ALLOY STEELS. J. Borrowdale, R. H. Jenkins, and C. E. A. Shanahan (Richard Thomas and Baldwin, Ltd., Whitchurch, Aylesbury, Eng.). Analyst 84, 426-33 (1959) July.

A study was made of certain variables in a methyl borate distillation procedure for the determination of total boron in steel by the curcumin color reaction. This led to a procedure that can be used for plain-carbon and alloy steels. A single determination takes approximately 3 hours, assuming that the initial dissolution of the sample does not take longer than 30 minutes. Results are presented to show the accuracy and precision of the method when applied to boron contents between 0.002 and 0.100% in steels of widely different compositions. (auth)

19871

INDUSTRIAL PRODUCTION OF HEAVY WATER. M. P. Malkov. Atomnaya Energ. 7, 101-9(1959) Aug. (In Russian)

The economics and technology of heavy water production on an industrial scale are discussed. The low-temperature distillation and hydrogen sulfide methods are suggested as best. (tr-auth)

19872

SORPTION METHODS OF SEPARATING BARIUM FROM RADIUM, ALUMINUM FROM GALLIUM, AND ZIRCONIUM FROM HAFNIUM. B. N. Laskorin, V. S. Ulyanov, R. A. Sviridova, A. M. Arzhatkin, and A. I. Yuzhin. Atomnaya Energ. 7, 110-16(1959) Aug. (In Russian)

An effective chromatographic separation method was achieved by using complex-forming substances capable of reducing the active concentration forces in ions subjected to separation. In the first approximation such separation amounts to reduction of the number of elements. The difference in complex-forming constants increases the separation coefficient. Optimum conditions were found, using various complex-forming elements, for separating barium and radium, zirconium and hafnium, and aluminum and gallium. The efficiency of the methods is 15 to 60 kg/hr per m^2 of the scale. (tr-auth)

19873

SEPARATING ZIRCONIUM AND NIOBIUM BY REVERSED-PHASE PARTITION CHROMATOGRAPHY. S. Sekerskiĭ and V. Kotlinskaya (Inst. of Nuclear Research, Academy of Sciences, Warsaw). Atomnaya Energ. 7, 160-2(1959) Aug. (In Russian)

Separation of zirconium and niobium was achieved by

reverse-phase partition chromatography using tributyl phosphate sorption on silica gel. (R.V.J.)

19874

THE COMPOSITIONS AND DISSOCIATION CONSTANTS OF THE EDTA COMPLEXES OF Pu(III) AND Pu(V). A. D. Gel'man, A. I. Moskvin, and P. I. Artyukhin. Atomnaya Energ. 7, 162-3(1959) Aug. (In Russian)

The ion exchange method was used in complexing Pu(V) with ethylenediaminetetraactetic acid (EDTA). Preliminary experiments carried out with macroquantities of Pu(V) showed that it remained stable for several days. The original solution of Pu(V) was prepared by hydrogen peroxide recovery at pH = 3 to 4. The ion exchange method was also used in complexing Pu(III) in EDTA solution at pH 1.2 to 3.4. The partition of Pu(III) between the solution and adsorbent was carried out with an ion force of μ = (in 1M NH_4Cl). Complexing of various plutonium ions can be expressed by the sequence: $Pu^{4+} > Pu^{3+} > PuO_2^{2+} > PuO_2^+$. (R.V.J.)

19875

ISOTOPIC EXCHANGE OF ZINC CHELATE COMPOUNDS IN AN ANHYDROUS ORGANIC SOLVENT. Kazuo Saito and Michiko Tamura (Univ. of Tokyo). Bull. Chem. Soc. Japan 32, 533-4(1959) May.

The isotopic exchange of zinc in its complexes was thought to be accelerated by water. However, it was found the exchange proceeds instantaneously, even under anhydrous conditions. (C.J.G.)

19876

SEMICONTINUOUS COUNTERCURRENT APPARATUS FOR CONTACTING GRANULAR SOLIDS AND SOLUTION. C. W. Hancher and S. H. Jury (Oak Ridge National Lab., Tenn.). Chem. Eng. Progr. 55, Symposium Ser. No. 24, 87-99(1959).

Progress in engineering development and theoretical studies of countercurrent ion exchange equipment is summarized. (J.E.D)

19877

THE EXTRACTION OF RUTHENIUM NITROSONITRATE BY BUTYLPHOSPHINIC ESTERS. A. V. Nikolaev and N. M. Sinitsyn (Inst. of Inorganic Chemistry, Siberian Section of the Academy of Sciences, U.S.S.R.). Doklady Akad. Nauk S.S.S.R. 127, 117-19(1959) July 1. (In Russian)

The extraction behavior of ruthenium nitrosonitrate in the butyl and dibutyl esters of butylphosphinic acid was analyzed. (R.V.J.)

19878

TUNGSTATES OF ZIRCONIUM AND HAFNIUM. V. I. Spitsyn, L. N. Komissarova, and Z. A. Vladimirova (Lomonosov Moscow State Univ.). Doklady Akad. Nauk S.S.S.R. 127, 120-3(1959) July 1. (In Russian)

The synthesis and properties of hydrated and anhydrous tungstates of zirconium and hafnium are investigated. (R.V.J.)

19879

ISOTOPIC GEOCHEMISTRY OF SULPHUR. W. U. Ault and J. L. Kulp (Columbia Univ., New York). Geochim. et Cosmochim. Acta 16, 201-35(1959) July.

The isotopic composition of sulfur was determined for a large number of specimens representing the important geochemical phases in which sulfur is present. The most significant process that causes sulfur isotopic fractionation is the reduction of dissolved sulfate by bacteria, although other processes such as distillation of volcanic emanations, oxidation-reduction of H_2S, SO_2, and S during volcanism, and sulfide–sulfate equilibrium under magmatic or hydrothermal conditions can be locally important. The new data are combined with earlier work in an attempt to define the range and average S^{32}/S^{34} ratio of the various sulfur-bearing phases of the crust. The most important averages are meteorites, ocean sulfate, mafic rocks, plutonic silicic rocks, hydrothermal sulfides, and sedimentary sulfide and post-Cambrian evaporite sulfate. A material balance calculation of the sulfur isotopes in the crust, although subject to considerable uncertainties, points to an average crustal composition of sulfur heavier than that for meteorites. No age effect is found for at least the last 2×10^9 years. Finally, a geochemical theory is described to account for the apparent distribution of sulfur isotopes in the lithosphere. (auth)

19880

THE ISOTOPE CONTENT OF THE CARBON IN FRESH WATER CARBONATE DEPOSITS. J. C. Vogel (Universität, Heidelberg, Ger.). Geochim. et Cosmochim. Acta 16, 236-42(1959) July.

An attempt is made to interpret the observed C^{13}/C^{12} ratio in fresh-water carbonates in terms of the origin of the carbon and the isotope exchange constants involved. Measurements of the isotope ratio of the inorganically dissolved carbon in hard ground waters are reported. It appears that the average depletion in C^{13} content of about 14% compared with Solnhofen limestone can be explained quite satisfactorily on this basis. It is shown that the expected isotope ratio of calcium carbonate precipitated from such water is compatible with that of sinter. A few measurements of sinter samples are given and the results on a number of loess samples are discussed. Although considerable caution is necessary when applying isotopic data to geological problems it is felt that with a better understanding of the mechanisms valuable conclusions can be drawn from the C^{13}/C^{12} ratio of carbonates. (auth)

19881

X RAY SPECTRA OF COMPOUNDS WITH PEROVSKITE STRUCTURE. A. T. Shuvaev (Rostov State Univ.). Izvest. Akad. Nauk S.S.S.R., Ser Fiz. 23, 569-72(1959) May. (In Russian)

The intensity of titanium fluorescence K spectra in $BaTiO_3$, $CaTiO_3$, $PbTiO_3$, $SrTiO_3$, and Ti_2O_3 was measured. (R.V.J.)

19882

DIFFUSION-CONTROLLED REACTIONS IN SOLIDS. Howard Reiss (Bell Telephone Labs., Inc., Murray Hill, N. J.). J. Appl. Phys. 30, 1141-52(1959) Aug.

A discussion is given of those diffusion processes commonly referred to as diffusion-controlled reactions. Attention is focused on those aspects of the phenomena to which special care must be given in developing theoretical analyses. The discussion is documented with several experimental examples drawn from the chemical physics of semiconductors, e.g., annealing of radiation damage, ion pairing, precipitation, and the formation of complexes in solids. (auth)

19883

DEUTERIUM POSITIONS IN LANTHANUM DEUTEROXIDE BY NEUTRON DIFFRACTION. Masao Atoji and Donald E. Williams (Iowa State College, Ames). J. Chem. Phys. 31, 329-31(1959) Aug.

The deuterium positions in $La(OD)_3$ have been determined by the neutron diffraction method. No hydrogen bonding was found in this structure. The close packing structure around the deuterium atom is characterized

by the average distances of D—D = 2.29 A and D—O = 2.74 A. The infrared absorption spectra of $La(OD)_3$ and $La(OH)_3$ are briefly discussed. (auth)

19884

STRUCTURES OF CALCIUM DICARBIDE AND URANIUM DICARBIDE BY NEUTRON DIFFRACTION. Masao Atoji and Ronald C. Medrud (Iowa State College, Ames). J. Chem. Phys. 31, 332-7(1959) Aug.

The C—C distances of the C_2 groups in calcium dicarbide and uranium dicarbide have been determined by the powder neutron diffraction method. The C—C distance in calcium dicarbide is 1.20 ± 0.01 A, equal to the triple bond C—C distance, but not 1.4 A as reported previously. Uranium dicarbide is isostructural with calcium dicarbide and has the C—C distance of 1.34 ± 0.01 A essentially that of a C—C double bond. The interatomic distances in calcium dicarbide, uranium dicarbide, lanthanum dicarbide, and lanthanum sesquicarbide are discussed in connection with the electronic configuration of the C_2 group. (auth)

19885

ELECTRON SPIN RESONANCE OF ULTRAVIOLET IRRADIATED COMPOUNDS. I. UNSATURATED HYDROCARBONS. Charles P. Poole, Jr. and Roy S. Anderson (Univ. of Maryland, College Park). J. Chem. Phys. 31, 346-54(1959) Aug.

Trapped radicals, formed by ultraviolet irradiation of pure, unsaturated aliphatic hydrocarbons, maintained at 77°K, have been observed with a 3-cm electron spin resonance spectrometer at a g factor of two. Straight-chain alkene radicals were characterized by well-resolved hyperfine structure of four or more components. Branched-chain alkene radicals showed more but poorly resolved components. Only those hydrogen atoms attached to carbon atoms at or adjacent to the location of the unpaired electron are found to contribute appreciably to the observed hyperfine structure. Their hyperfine coupling constants are approximately equal. Radical formation and stabilization is attributed to the separation from the parent molecule of highly mobile hydrogen and methyl radicals which diffuse away from the remaining radical fragments, and eventually react with their environment or recombine. Stabilization of remaining fragments then occurs because of immobility and structural resonance. The number of radical spins detected was of the order of 10^{16} to 10^{18} in 1-ml samples. Most radicals were stable for weeks at 77°K. Consideration is given to the existence of radicals resulting from secondary hydrogen addition reactions. (auth)

19886

GROWTH MECHANISM FOR GRAPHITE WHISKERS. Gerald W. Sears (General Electric Research Lab., Schenectady, N. Y.). J. Chem. Phys. 31, 358-60 (1959) Aug.

A mechanism is described which gives rise to the scroll habit which has been observed from graphite whiskers. A supersaturation region exists which would favor the postulated growth mechanism. (auth)

19887

SOLVENT EXTRACTION WITH AMINES. I. THE SYSTEM Th—HNO_3—TRIOCTYLAMINE. D. J. Carswell (New South Wales Univ. of Tech., Kensington, Sydney) and J. J. Lawrence (A.A.E.C. Research Establishment, Scutherland, Australia). J. Inorg. and Nuclear Chem. 11, 69-74(1959) June.

The extraction of nitric acid and thorium from nitric acid solutions into tri-n-octylamine and tri-iso-octylamine is reported. The results confirm the existence of an anionic thorium complex $Th(NO_3)_6^{2-}$, and a mechanism is suggested for the extraction of this complex. (auth)

19888

LIQUID SCINTILLATION COUNTING OF HISTAMINE-C^{14} AND ITS METABOLITES. Gildon N. Beall and Paul P. VanArsdel, Jr. (Univ. of Washington, Seattle). J. Lab. Clin. Med. 54, 487-94(1959) Sept.

Techniques of liquid scintillation assay of C^{14} have been evaluated for the measurement of plasma and urinary radioactivity, following the administration of histamine-C^{14} to human beings. The only practicable method consisted of the incorporation of water-soluble material into a mixture of p-dioxane, anisole, and 1,2-dimethoxyethane (polyether 611), which also contained two standard scintillation phosphors. Problems of solubility necessitated the dilution of all samples with water, thus reducing the amount of sample which could be assayed. Other advantages of liquid scintillation assay, such as ease of sample preparation and high counting efficiency (58.6 per cent), made this approach worthwhile. Radioactivity equivalent to 0.3 μg histamine base per 100 ml plasma or 8 μg per liter of urine could be reliably detected. The variable tendency of urine samples to quench scintillation necessitated the addition of an internal standard to each sample in order to establish counting efficiency. (auth)

19889

KINETICS OF OXIDATION OF URANIUM BY CARBON DIOXIDE. J. E. Antill and K. A. Peakall (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Less-Common Metals 1, 227-31(1959) June.

The rates of oxidation of uranium by carbon dioxide have been determined over the range 500 to 1000°C. The rate increases with temperature from 500 to 780°C with a sudden marked increase when the metal is near or at the β—γ transition (772°C). At higher temperatures up to 1000°C the rate decreases with increasing temperature. The reaction obeys a linear rate law for the range 500 to 800°C, although self-heating sometimes results in a non-linear weight increase—time graph. In the range 500 to 725°C the activation energy is 26 ± 10 kcal/mole which is consistent with oxygen ion diffusion being the rate controlling mechanism. (auth)

19890

THE SATURATION VAPOR PRESSURE OF THALLIUM CHLORIDE. K. A. Bol'shakov, P. I. Fedorov, and M. N. Shakhova. Nauch. Doklady Vysshei Shkoly Khim. i Khim. Tekhnol. No. 3, 408-12(1958).

The saturation vapor pressure of thallium chloride was determined by the method of boiling points, and the method of saturated current. The use of these two methods made it possible to cover a great temperature range and, after analysis of the results obtained, to draw conclusions on the molecular state of thallium chloride. Results are tabulated. (auth)

19891

THE SOLUBILITY IN THE SYSTEMS: $LaCl_3$—NaCl—H_2O, $NdCl_3$—NaCl—H_2O, $LaCl_3$—$CaCl_2$—H_2O, and $NdCl_3$—$CaCl_2$—H_2O at 25°. Z. N. Shevtsova, V. S. Zelova, and L. I. Ushakova. Nauch. Doklady Vysshei Shkoly Khim. i Khim. Tekhnol. No. 3, 417-21(1958).

The isothermal lines of several chloride salt systems were investigated at 25°C. The results are given in tables and diagrams. The composition of the solid phases was determined chemically and crystal-optically

and was graphically determined according to the method of Shreynemakers. Isometrically, the solubility in the systems was found to be $LaCl_3$–NaCl–H_2O, $NdCl_3$–NaCl–H_2O, $LaCl_3$–$CaCl_2$–H_2O, $NdCl_3$–$CaCl_2$–H_2O. Lanthanum and neodymium chloride form crystal hydrates with the compositions $LaCl_3 \cdot 7H_2O$ and $NdCl_3 \cdot 6H_2O$. (auth)

19892

THE CATHODIC POLARIZATION IN THE ELECTROLYTIC SEPARATION OF A TIN–NICKEL ALLOY. N. T. Kudryavtsev and K. M. Tyutina. Nauch. Doklady Vysshei Shkoly Khim. i Khim. Tekhnol. No. 3, 435–8 (1958).

The presence of sodium and ammonium fluoride increases the cathode potential of tin to the point where it approaches the separation potential of nickel from chloride solutions. The potential in the simultaneous separation of tin and nickel at the cathode is a higher positive quantity than the potentials in the individual separation of tin and nickel. The course of the polarization curves in the separation of the alloy and its constituent parts from chloride–fluoride solutions was traced. Analysis of these curves revealed that the simultaneous deposition of tin and nickel on the cathode is accompanied by a considerable depolarization. The nature of the polarization was investigated according to various methods. Mainly chemical polarizations were concerned due to the fact that the complex ions of the deposited metals are very stable. The experimental results show the cathodic polarization in the electrolytic separation of tin, nickel, and the Sn–Ni alloy. (auth)

19893

THE INFLUENCE OF A NON-AQUEOUS SOLVENT ON THE ADSORPTION OF RADIOACTIVE MICROCOMPONENTS BY A NUMBER OF ADSORBANTS. S. A. Voznesenskii, V. D. Puzako, and L. B. Levasheva. Nauch. Doklady Vysshei Shkoly Khim. i Khim. Tekhnol. No. 3, 452–4(1958).

The influence of ethyl alcohol and acetone on the adsorption of microamounts of Cs^{137} and Sr^{89} by ultramarine, iron oxide, barium sulfate, and titanium dioxide in water at room temperature was investigated. It was found that the addition of non-aqueous solvents usually increases the adsorption of the microcomponents, sometimes more than 10-fold. Only in the adsorption of cesium on barium sulfate was the adsorption decreased by the addition of ethyl alcohol or acetone to the aqueous solution. Experimental condition variations are described. (auth)

19894

ON THE EFFECT OF THE GAMMA RADIATION OF Co-60 ON STARCH. V. F. Oreshko and K. A. Korotchenko. Nauch. Doklady Vysshei Shkoly Khim. i Khim. Tekhnol. No. 3, 455–9(1958).

Concentrated gel of potato starch (13.5% dry substance) was subjected to radiation doses of 2.28, 4.80, and 6.04×10^6 r. Observation of the structural change of the gel, the volume measurement of the synergetic liquid, and its content of dry substance served for the classification of the effect of gamma radiation. The extent of the chemical transformations was determined by qualitative reactions with iodine and Fehling's solution, as well as by quantitative determination of the reduced substances and spectrophotometric examination. Data and diagrams are included. (auth)

19895

THE INVESTIGATION OF THE COMPLEX FORMATION IN THE SYSTEM Th^{4+}–ACETYLACETONE–H_2O–C_6H_6 BY MEANS OF THE DISTRIBUTION METHOD. V. M. Peshkova and A. P. Zozulya. Nauch. Doklady Vysshei Shkoly Khim. i Khim. Tekhnol. No. 3, 470–4(1958).

The distribution of Th^{4+} in the system C_6H_6–H_2O–acetylacetone at 25 ± 0.1° was investigated. The ionic strength in the aqueous phase amounted to 0.1. An aliquot of $Th(ClO_4)_4$ solution was mixed with the calculated amount of NaOH and $NaClO_4$ solution and diluted with water to 15.0 ml. Fifteen ml solution of acetylacetone in benzene were added to this. The sample was stored in a controlled oven 20 hours to establish equilibrium and the phases separated by centrifuging. Thorium was determined in both phases by means of morin. The dependence of the ratio of the distribution of Th^{4+} on the concentration of the free acetylacetone ions is shown graphically. The numerical results are tabulated. The coefficients of the distribution of Th_4-acetylacetone, and the constants of the formation of the various thorium-acetylacetonate complexes are also tabulated. (auth)

19896

THE ELECTROLYSIS OF POTASSIUM BIFLUORIDE SOLUTION IN ANHYDROUS ACETIC ACID. M. Ya. Fioshin, Ye. S. Popova, and A. P. Tomilov. Nauch Doklady Vysshei Shkoly Khim. i Khim. Tekhnol. No. 3, 533–5(1958).

The products of the electrolysis of potassium bifluoride in anhydrous acetic acid solution with an insoluble anode were investigated. The electrolysis was carried out in cells without a diaphragm to separate the anodic from the cathodic space. The results obtained showed that a change in the current density from 0.01 to 0.1 a/cm^2 and an increase in temperature from 20 to 70°C do not influence the character of the electrolytic process. The results obtained showed that at the cathode, hydrogen is formed in quantity according to Faraday's law. Ethane, acetylfluoride, and CO_2 occur in addition to hydrogen as the gaseous products formed in the electrolysis. Acetic acid methylacetate was also found in the liquid products formed in the electrolysis. Some 90% of the current was consumed at the platinum electrode for the formation of ethane and CO_2 according to the Kolbe reaction. The rest served for the destruction of the anode and for the formation of methylalcohol according to the Hofer–Moest reaction. (auth)

19897

ON POLYNUCLEAR CHLORIDES OF NIOBIUM AND TANTALUM. Ye. I. Krylov. Nauch Doklady Vysshei Shkoly Khim. i Khim. Tekhnol. No. 4, 676–9(1958).

The valence state of the atoms of niobium in the polynuclear compounds $Nb_6Cl_{14} \cdot 7H_2O$ and $Ta_6Cl_{14} \cdot 7H_2O$ was investigated. The syntheses of the initial products were carried out by the reduction of $NbCl_5$ ($TaCl_5$) with Na amalgam in evacuated tubes of molybdenum glass at 400°C. The measurement of magnetic susceptibility was carried out by Gouy's method at 78, 206, 273, and 293°K. The polynuclear chlorides of niobium and tantalum are paramagnetic. It was found that within the temperature range of 78 to 293°K the magnetic susceptibility of these compounds obeys the Curie-Weiss law. In the molecules $Nb_6Cl_{14} \cdot 7H_2O$ and $Ta_6Cl_{14} \cdot 7H_2O$ Me–Me atom bonds are present. It is shown that in the composition of the molecules of polynuclear compounds of niobium and tantalum two positive paramagnetic ions Nb^+ (Ta^+) and 4 diamagnetic atoms Nb(Ta) are present. (auth)

19898

INVESTIGATION OF THE COMPLEX COMPOUND OF

URANIUM WITH MIRICITRINE. P. A. Zagorets. Nauch. Doklady Vysshei Shkoly Khim. i Khim. Tekhnol. No. 4, 680-4(1958).

The absorption spectra of uranium complexes with miricitrine are measured, and the composition of these complexes is determined. Miricitrine is a derivative of 3,5,7,3',4',5'-hexaoxy flavone, the structural formula of which is given. The absorption spectra of miricitrine and the complex compound of uranium with miricitrine were measured in the visible and in the ultraviolet range. The dependence of the optical density of uranium-miricitrine complex solution on the pH value of the solution was investigated. The maximum intensity of the coloring of the complex is obtained after 15 minutes and remains stable up to 12 hours. The intensity of the coloring remains the same within the temperature range of 15 to 25°C. Upon heating above 35°C, a change of the absorption curve of the complex is observed. Uranium with miricitrine forms complex compounds at a ratio between uranium and miricitrine of 1:1, 2:1, and 3:1. Two methods of synthesizing the complex compounds of uranium with miricitrine are described. Reaction results showed that in the case of a uranium excess, complexes are formed of a ratio of 3:1 of uranium and miricitrine. In the case of an excess of miricitrine the complexes formed with a ratio of 1:1 between uranium and miricitrine. Stoichiometric formulas for uranium complexes with miricitrine are presented. (auth)

19899

COMPENSATION VARIANT OF PHOTOCOLORIMETRIC pH DETERMINATION. M. I. Kulenok. Nauch. Doklady Vysshei Shkoly Khim. i Khim. Tekhnol. No. 4, 693-5 (1958).

A new variant of the colorimetric pH determination of a solution is described. The method is applied to the determination of the pH value in the range of 8.0 to 10.0, using a carbonate-borate buffer solution. The determination of the pH value is carried out by means of the colorimetric photometer (FEK-M). Other buffer systems and indicators were used for other ranges of the pH determination. The compensation variant for the photometric determination of the pH-value is specially suited for series determinations. A parallel determination of the pH value with some solutions was carried out according to the electrometric method. From the results obtained it may be concluded that the scattering of the values is not >0.01 pH units. The compensation method is said to be highly sensitive and reliable. (auth)

19900

SPECTROPHOTOMETRIC DETERMINATION OF THE pH VALUE WITH BROMTHYMOL BLUE AS AN INDICATOR. A. A. Bol'shakova. Nauch. Doklady Vysshei Shkoly Khim. i Khim. Tekhnol. No. 4, 696-9(1958).

The stepwise character of the acid formation of bromthymol blue indicators is used for the determination of the pH value of solutions. Two absorption zones of the indicator in the visible range are determined. The maximum of the zone for the acid form is at 400 to 430 mμ and for the alkaline range at 610 mμ. The zone of the acid form of the indicator reflects the stepwise character, and each pH-value has a corresponding $\lambda_{maximum}$. Methods of determining the pH value of bromthymol blue were suggested. From the data on optical density the pH value of the solution is determined using the calibrating plot for the indicator bromthymol blue. (auth)

19901

THE RADIOGRAPHIC INVESTIGATION OF THE PRODUCTS OF CHEMICAL REACTIONS IN SPECTROSCOPIC DETERMINATIONS OF NIOBIUM. N. I. Tarasevich, K. A. Semenenko, and K. N. Semenenko. Nauch. Doklady Vysshei Shkoly Khim. i Khim. Tekhnol. No. 4, 700-5(1958).

Products formed on the carbon electrode in the spectrum analysis of niobium were radiographically investigated. Samples investigated were: Nb + C, Si + C, Nb + Si + C, Nb_2O_5 + C, Nb_2O_5 + Si + C, and Nb_2O_5 + SiO_2 + C. The radiographic investigation shows that in the interaction of metallic niobium with carbon, niobium carbide is formed. In the interaction between silicon and carbon, SiC is formed. The interaction between carbon and a mixture of Nb and Si is complex, and phases such as cubic NbC and tetragonal β-Nb_5Si_3 were identified. The interaction of Nb_2O_5 with the carbon electrode shows only a modification of Nb_2O_5 with small impurities of NbO_2. Lower niobium oxides were not determined. In the interaction between niobium pentoxide Nb_2O_5 and elementary silicon with carbon NbO_2 and a phase difficultly identified are formed. The interaction between niobium pentoxide Nb_2O_5 and silicon dioxide with carbon leads to the formation of NbO_2 and niobium pentoxide. In the presence of elementary silicon and SiO_2 niobium dioxide is formed on the carbon crater during the spectroscopic determination of niobium. (auth)

19902

THE SEPARATION OF THALLIUM FROM ACCOMPANYING ELEMENTS BY COPRECIPITATION WITH SILVER IODIDE. Yu. V. Morachevskii, G. V. Yefremov, and Hsu Chi-ku. Nauch. Doklady Vysshei Shkoly Khim. i Khim. Tekhnol. No. 4, 706-9(1958).

Detailed investigations concerning conditions of the coprecipitation of microquantities of thallium with silver iodide under the simultaneous separation of the element from its accompanying elements were carried out. The complete coprecipitation of thallium depends on the pH value of the solution and the setting time of the precipitate. The maximum coprecipitation occurs at pH 2 and 3. Maintaining optimum conditions, it is possible to obtain the quantitative coprecipitation of thallium with silver iodide from dilute solutions (0.1 γ Tl in 25 ml). The quantitative separation of microquantities of thallium from the accompanying elements chromium, mercury, antimony, gold, and copper was determined. By means of Sb^{124} it was shown that under optimum conditions for the quantitative coprecipitation of thallium no antimony is coprecipitated with silver iodide. In the presence of large quantities of mercury it is necessary to repeat the process as mercury is coprecipitated in large amounts with silver iodide. (auth)

19903

INVESTIGATION OF THE ADSORPTION OF TRIVALENT ANTIMONY FOR MANGANESE DIOXIDE. P. N. Kovalenko. Nauch. Doklady Vysshei Shkoly Khim. i Khim. Tekhnol. No. 4, 710-13(1958).

The influence of manganese(II) ions on the colorimetric determination of antimony was investigated. It was found that large quantities of manganese do not exert any influence upon the accurate determination of antimony. The adsorbability of MnO_2 for antimony in relation to the concentration of the antimony solution was investigated. The adsorption represents a hyperbolic curve and obeys the Freundlich adsorption law. The adsorbability of antimony for MnO_2 depends on

time; within two hours the adsorption decreases from 80 to 30%. The highest adsorbability of the MnO_2 was found immediately after its formation. (auth)

19904

ADSORPTION OF ANTIMONY ON COPPER HYDROXIDE AND THE ELECTROLYTIC SEPARATION OF $Cu(OH)_2$ FROM ANTIMONY. P. N. Kovalenko and N. P. Moricheva. Nauch. Doklady Vysshei Shkoly Khim. i Khim. Tekhnol. No. 4, 714-17(1958).

The adsorption of antimony(III) on copper hydroxide corresponds to the Langmuir adsorption isotherm. The rapid separation of copper from small amounts of antimony is carried out electrolytically from ammoniacal or hydrochloric solutions in the presence of the depolarizer ammonium persulfate. After the electrolysis small amounts of copper in antimony do not disturb the spectrophotometric determination of antimony with the methyl violet complex. In the presence of antimony(V) it is necessary to carry out a reduction with $SnCl_2$ solution. (TCO)

19905

THE DETERMINATION OF ETHYLENEDIAMINE-TETRAACETIC ACID IN THE PRESENCE OF THE RARE EARTH ELEMENTS. L. I. Martynenko. Nauch. Doklady Vysshei Shkoly Khim. i Khim. Tekhnol. No. 4, 718-20(1958).

A method for the rapid determination of ethylenediaminetetraacetic acid in the presence of rare earths is described. The method can be employed to separate the rare earths with ion exchangers by means of H_4Y. For the determination of the H_4Y content, the complexometric titration of H_4Y with calcium salt solutions was carried out with ammonium oxalate as indicator at pH 8 to 9. During titration the pH value has to be regulated continuously. The initial content of H_4Y can be determined by the known quantities of the rare earth ions in the samples and by the added quantities and the back-titrated content of H_4Y. (TCO)

19906

ON THE DETERMINATION OF THE REACTIVITY OF HYDROGEN ATOMS IN ORGANIC COMPOUNDS. THE KINETIC ISOTOPE EFFECT OF TRITIUM IN RADICAL REACTIONS OF THE CYCLOPARAFFINS. V. L. Antonovskii and I. V. Berezin. Nauch. Doklady Vysshei Shkoly Khim. i Khim. Tekhnol. No. 4, 731-5(1958).

A method for the quantitative determination of the relative reactivity of hydrogen atoms in organic compounds was suggested. The relative reactivity of hydrogen atoms in cyclopentane and cyclohexane was determined. The kinetic hydrogen tritium isotope effect in the reactions of CH_3 with cyclopentane, cyclohexane, and cycloheptane was measured. (TCO)

19907

THE RADIO-CHEMICAL STABILITY OF THE ION EXCHANGE RESINS UNDER THE INFLUENCE OF γ- AND β-RAYS ON THE CATIONITES. A. P. Polevodov, V. A. Nikashina, A. V. Gordiyevskii, M. M. Senyavin, and A. Kh. Breger. Nauch. Doklady Vysshei Shkoly Khim. i Khim. Tekhnol. No. 4, 761-4(1958).

The radiochemical stability of the cationites KU-2, KU-1, SBS, RF, and KB-4 under the influence of γ and β rays was investigated. Co^{60} was used as the γ radiator. In the irradiation the capacity of the cationites is reduced. The chemical stability is reduced by the irradiation, and the capability of swelling of the resins KU-2 and KB-4 decreases, whereas it increases with the resins KU-1 and RF. The quantity of the functional group of the cationites becomes smaller with increasing activity. The ion exchangers of aromatic structure are more stable than resins of aliphatic structure. Gamma and β irradiation has the same influence on the cationites. The irradiation of cationites in air under the influence of γ rays causes deeper destructive changes in the cationites. (auth)

19908

NEW PLASTICS. Nauka i Zhizn 25, No. 12, 70(1958).

Layers of liptobiolite-rhabdopissite were recently discovered in coal seams located at the city of Tkibuli, northeast of Kutaisi, one of the largest industrial centers of the Georgian SSR. The Chemical Institute of the Academy of Sciences of the Georgian SSR elaborated a method for the manufacture of a plastic material which has good electro-isolating and acid-resistant properties. (TCO)

19909

DETERMINATION OF ZIRCONIUM IN ROCKS AND QUARTZ SANDS RICH IN IRON. Maria Lucco Borlera (Istituto di chimica generale e applicata e di metallurgia del Politecnico, Turin). Ricarca sci. 29, 1465-71(1959) July. (In Italian)

A method for the determination of small quantities of zirconium (some units per thousand) in rocks and quartziferous sands of high iron contents was developed. The major part of the iron is eliminated by distillation in a chlorine stream and in the presence of graphite at approximately 350°C. A second distillation at 650°C permits the quantitative separation of zirconium as tetrachloride. The determination of zirconium in the distillate is performed by amperometric titration through its precipitation with cupferron. The interference of the residual trivalent iron is eliminated by reducing it with ascorbic acid. (auth)

19910

Mo/Mn SEPARATION BY ANION EXCHANGE AND DETECTION OF Mn BY NEUTRON ACTIVATION. Vera Maxia (Università, Cagliari, Italy). Ricarca sci. 29, 1476-80(1959) July. (In Italian)

A method for separating small quantities of manganese by means of Dowex I anion exchange resins is described. Manganese is then determined by irradiating the solution with slow neutrons and comparing the activity produced with that of a standard solution. The tests performed have permitted a complete separation of the manganese. (auth)

19911

DENSITOMETRY BY ACTIVATION ANALYSIS. Giovanna Mayr (Università, Milan). Ricarca sci. 29, 1481-9(1959) July. (In Italian)

It was demonstrated that the silver present in a processed film can be evaluated by means of activation analysis. In this way dosimetry of radioautographs can be done also when the density is not uniform. The method was checked by exposing processed films and standards of pure Ag in the Harwell pile. The conditions for activation in the gamma beam of a 30-Mev synchrotron were also studied. (auth)

19912

PROBLEMS IN THE DESIGN OF COMBINED CATIONITE WATER PURIFICATION INSTALLATIONS WITH MAGNESIA DESILICATION. A. A. Krupchitskii. Teploenergetika No. 3, 61-6(1959).

Aspects of water purification for thermal power stations are examined. The use of steam pressures of 140 atm. and more somewhat limits the field of application of water purification installations with magnesia desilication. In the case of condensing stations using these

steam conditions, desilication is replaced by desalting or evaporation. Again, heat and power stations which deliver industrial process steam can only use a limited proportion of desilicated water for make-up. In such stations the normal conditions of condensate return govern the water purification process used, while the emergency conditions of condensate return govern the output of the water purification plant. When constructing a station, the desalting installation should be built first, so that the boilers can be supplied while the station is being started up. The inclusion of desilication facilities is much more advantageous in stations with boiler pressures of 100 atm. and lower. Design experience has shown that the obligatory use of standard designs has many disadvantages. It should suffice to standardize the water purification building and such individual components of the plant as affect the unloading of reagent regeneration circuit, etc. The principal technological fundamentals of the design should conform to the particular conditions at the station. At present, automatic control of water purification is very expensive and its full application to large water purification installations would be uneconomic. It is considered necessary to ensure that only high-quality reagents are delivered, particularly lime and filtering materials. It is also necessary to develop and organize the production of measuring apparatus, automatic instruments and other water purification equipment. A research center is required to deal with problems of water purification and a special design organization should also be set up. (TCO)

19913

N.M.R. CHEMICAL SHIFTS IN SOLUTIONS CONTAINING Tl^{205}. PART 1. B. N. Figgis (University Coll., London). Trans. Faraday Soc. 55, 1075–85(1959) July.

The chemical shifts which the Tl^{205} nucleus undergoes when various anions are added to solutions containing the thallic ion are reported. It is found that the resonances for the solutions cover a range of some 1800 ppm (9 gauss in 5,000) but do not overlap with the range of chemical shifts known for the thallous ion. With the anions Cl^- and Br^- the chemical shifts change at a very large and varying rate with the ratio $[X^-]/[Tl^{3+}]$. This behavior is taken to result from complex formation between the thallic ion and the halide ion; the existence of the $Tl_2X_6^{3-}$ ion as the most stable species in the solutions is indicated. There is also evidence for complex formation with SO_4^{2-}. It is also found that the line width of the Tl^{205} resonances in the solutions varies with the ratio of added anion concentration to thallic ion concentration and at times supports the identification of the species made on the grounds of the chemical shifts. The line widths in solutions containing Br^- also indicate that the exchange of thallic ion between different chemical environments may not be very fast. (auth)

19914

ON THE USE OF RADIOGRAPHY IN WORK ON THE THEORY OF FLOTATION. I. A. Kakovskii, S. V. Bessonov, V. I. Klassen, and A. K. Livshits. Tsvetnye Metal. No. 3, 72–8(1959).

A discussion arising from the use of radiographic methods of reagent distribution on the surface of mineral particles in flotation theory work is outlined. Several criticisms of the methods are presented along with the authors comments in support of his procedures. (TCO-J.R.D.)

19915

ON BERYLLIUM OXIDE SALTS. K. N. Semenenko. Vestnik Moskov. Univ. Ser. Mat., Mekhan., Astron., Fiz. i Khim. 13, No. 5, 151–63(1958). (In Russian)

A review is given on the preparation, properties, and uses of oxide salts of $Be_4O(RCOO)_6$. (R.V.J.)

19916

SEPARATION OF MOLYBDENUM FROM IRON, ALUMINUM, AND CALCIUM BY ANIONS. Yu. V. Morachevskiĭ and M. N. Gordeeva (Leningrad State Univ.). Zavodskaya Lab. 23, 1066–70(1957). (In Russian)

Experiments were made on molybdenum separation from aluminum, calcium, and iron in nitric and hydrochloric acids by anion exchange using PE-9 resin. (R.J.V.)

19917

AN EXPERIMENT IN APPLYING MATHEMATICAL STATISTICS METHODS FOR ERROR EXAMINATION IN X-RAY SPECTROGRAPHIC ANALYSIS. I. D. Shevaleevskii, V. V. Nalimov, and E. E. Vaĭnshteĭn (Vernadskii Inst. of Geochemistry and Analytical Chemistry, Academy of Sciences, U.S.S.R.). Zhur. Anal. Khim. 14, 396–403(1959) July–Aug.

The precision of the x-ray spectrographic determination of Zr and Hf in ores and minerals is studied. A normal distribution is shown to occur. By analysis of the variance, the total standard deviation is divided into three components; (1) a standard deviation of repeatability, which characterizes the dispersion of the results of an analysis with respect to the arithmetic mean obtained on a film with a single rubbing of the sample into the target, (2) a standard deviation which characterizes the instability of the process of rubbing the sample into the target, and (3) a standard deviation due to the factors slowly changing in time, the most important one being the instability of the process of the film development. It is shown that chiefly a parallel displacement of calibration curves in time takes place. Optimum conditions for carrying out the analysis are considered. (auth)

19918

THERMOSPECTROPHOTOMETRIC DETERMINATION OF RARE EARTHS IN THE PRESENCE OF THORIUM. V. I. Kuzn'etsov and T. V. Petrova (Vernadskii Inst. of Geochemistry and Analytical Chemistry, Academy of Sciences, U.S.S.R.). Zhur. Anal. Khim. 14, 404–10 (1959) July–Aug.

A method when extinction is determined at two different temperature levels is called thermospectrophotometry. Arsenazo forms soluble complex compounds with thorium and rare earths. The violet solutions of these compounds behave differently under heating at different pH. The optical density of the thorium complex solution with pH 3.7 does not change at 576 mμ when the temperature changes from 20 to 80°, whereas the density of the rare earth complexes increases from 1.9 (La) to 2.9 (Yb) times. It is possible to determine the concentration of rare earths (from 1.2% of oxides) using a calibration curve and photometering at 20 and 80°. The experimental error is 7% at the concentration of 1.2% of RE_2O_3 in ThO_2 (RE — rare earths), and 1% at 15% of RE_2O_3 in ThO_2. The apparatus used and the procedure are described. (auth)

19919

DETERMINATION OF SMALL AMOUNTS OF RARE EARTHS IN PRASEODYMIUM, NEODYMIUM, SAMARIUM, TERBIUM, DYSPROSIUM, HOLMIUM, ERBIUM AND THULIUM PREPARATIONS. T. I. Grishina

(Lomonosov Moscow State Univ.). Zhur. Anal. Khim. 14, 427-30(1959) July-Aug.

Analytical lines suitable for determining ten thousandth parts of lanthanum, praseodymium, neodymium, samarium, europium, gadolinium, terbium, yttrium, dysprosium, holmium, erbium, thulium, and ytterbium were chosen on the basis of a study of their spectra in the region 3000 to 4600 A. (auth)

19920

PHOTOMETRIC DETERMINATION OF TITANIUM IN TITANIUM BORIDES WITH THE USE OF ARSENAZO. E. I. Nikitina. Zhur. Anal. Khim. 14, 431-3(1959) July-Aug.

A quantitative method was developed for the photometric determination of titanium with arsenazo, which forms with titanium a stable soluble violet compound at pH 2.6 to 3. The method permits the determination of 0.01 mg and more of titanium. The method was used for determining large quantities of titanium (up to 70%) in titanium boride. (auth)

19921

ON COMPLEXOMETRIC DETERMINATION OF MOLYBDENUM AFTER ITS REDUCTION TO PENTAVALENT STATE. A. I. Busev and Fan Chang (Lomonosov Moscow State Univ.). Zhur. Anal. Khim. 14, 445-50 (1959) July-Aug.

The range of acidities for the formation of the compound of pentavalent molybdenum with complexone III was determined. An accurate method was developed for determining pentavalent molybdenum by titrating the excess of complexone III with a zinc salt in the presence of chromogen black ET. The possibility of the direct photometric titration of pentavalent molybdenum was shown. (auth)

19922

QUANTITATIVE DETERMINATION OF OXYGEN IN LOW TITANIUM OXIDES BY ROENTGENOGRAPHIC ANALYSIS. L. M. Kuznetsov, E. S. Makarov, and Z. M. Turovtseva (Vernadskii Inst. of Geochemistry and Analytical Chemistry, Academy of Sciences, U.S.S.R.). Zhur. Anal. Khim. 14, 463-5(1959) July-Aug.

Some low titanium oxides were synthesized in the range 0 to 17% (wt.) of oxygen. It was found that the homogeneity region of low titanium oxides extends up to $TiO_{0.48}$ (about 14.4% (wt.) of oxygen). The dependence of the lattice constant c on the oxygen concentration was used for the quantitative determination of oxygen in low titanium oxides by the roentgenographic method. The accuracy of the method is ± 0.1% (wt.). (auth)

19923

DETERMINATION OF MOLYBDENUM IN ALLOYS WITH 8-MERCAPTOQUINOLINE. R. B. Golubtsova (Baikov Inst. of Metallurgy, Academy of Sciences, U.S.S.R.). Zhur. Anal. Khim. 14, 493-6(1959) July-Aug.

A method was developed for determining molybdenum in micro-samples of complex alloys. The influence of foreign ions was studied. The method permits the determination of molybdenum in the presence of large quantities of titanium. (auth)

19924

SPECTROGRAPHIC ANALYSIS BY THE EVAPORATION METHOD. COMMUNICATION 8. ANALYSIS OF ZIRCONIUM. A. N. Zaĭdel, L. V. Lipis, and K. I. Petrov. Zhur. Anal. Khim. 14, 497-500(1959) July-Aug.

The method of evaporation is used to determine some impurities in zirconium dioxide. Reproducible results are achieved by the use of cobalt and gallium as internal standards. As far as sensitivity and reproducibility of the determination of all the elements investigated (with the exception of Bi, Sn, Pb, Cd and Sb) are concerned, the vacuum modification of the evaporation method has all the advantage. (auth)

19925

THE ACIDITY FUNCTION OF THE SYSTEM DIETHYL ETHER–BF_3. G. B. Manelis, M. I. Vinnik, and N. M. Chirkov (Inst. of Chemical Physics, Academy of Sciences, Moscow). Zhur. Fiz. Khim. 33, 1030-4(1959) May. (In Russian)

The acidity function H_0 of the system ether–boron fluoride was determined over a broad range of concentrations. It was shown that in acidity ($H_0 = -6.22$ for 100%) $(C_2H_5)_2OBF_3$ exceeds phosphoric acid. Quantitative data on the rate of isobutylene polymerization agree well with those on the acidity function. An equation was proposed relating the acidity function and the concentration of $(C_2H_5)_2OBF_3$ in $(C_2H_5)_2O$. (auth)

19926

ATOMIZATION ENERGIES AND HEATS OF FORMATION OF SOME CARBIDES AND NITRIDES AND THE MOST PROBABLE VALUES FOR THE DISSOCIATION ENERGY OF NITROGEN AND SUBLIMATION ENERGY OF CARBON. B. F. Ormont (Karpan Physico-Chemical Inst., Moscow). Zhur. Fiz. Khim. 33, 1450-60(1959). (In Russian)

The question of utilizing in practice values for the atomization of solids (employing carbides, nitrides, etc., as examples) for estimating and selecting among available data, values for the sublimation energy of graphite and of some metals (zirconium and tantalum), for the dissociation energy of nitrogen, and for the enthalpy of formation of carbides and nitrides was examined. The most probable of the existing values (according to published reports) for the atomization energies of these substances, characterizing from an energy standpoint bond strengths in a lattice with covalent and metallic bonds, were compared. It was stressed that no linear relationship between the atomization energies and specific surface energies of these substances exists, nor can it exist. (auth)

19927

THERMODYNAMIC CHARACTERISTICS OF CRYSTALLINE COMPOUNDS CONTAINING LITHIUM. P. G. Maslov and Yu. P. Maslov. Zhur. Fiz. Khim. 33, 1687-90(1959) Aug. (In Russian)

Approximate general formulas for calculating the heats of formation and some other thermodynamic functions at 25°C of a large group of families of crystalline compounds containing lithium were derived by P. G. Maslov's method. As initial values for the corresponding thermodynamic functions the data in the Rossini, Wagman, et al. handbook published in 1952 were used. The accuracy of the calculations is sufficient for preliminary technological estimations. In many cases it is of the order of 0.2 to 1%, more seldom 1 to 10%. (auth)

19928

THE CRYSTAL STRUCTURE AND DENSITY OF CERIUM HYDRIDES. M. E. Kost and G. A. Gol'der. Zhur. Neorg. Khim. 4, 1488-90(1959) July. (In Russian)

The structure and density of cerium hydrides of CeH_2–CeH_3 composition were studied. Two phases were present in metallic cerium and its dihydrides (Ce–CeH_2). A negligible change in the lattice period from 5.55 A to

5.53 A for $CeH_{2.73}$ was observed for CeH_2-CeH_3. The cerium hydride density curve is at its minimum for dihydrides. Further saturation with hydrogen only slightly increases the density. (R.V.J.)

19929

DIPOLE MOMENTS OF ZIRCONIUM, TITANIUM, TIN, AND ALUMINUM HALIDES IN DIOXANE. O. A. Osipov and Yu. B. Kletnik. Zhur. Neorg. Khim. 4, 1494-7(1959) July. (In Russian)

Dipole moments of $AlBr_3$, AlI_3, $SnCl_4$, $SnBr_4$, $TlBr_4$, and ZrI_4 in dioxane were measured and correlated with published data. (R.V.J.)

19930

LANTHANUM COMPLEXES WITH GLUCONIC ACID. Ya. A. Fialkov and N. A. Kostromina (Inst. of General and Inorganic Chemistry, Academy of Sciences, Ukrainian S.S.R.). Zhur. Neorg. Khim. 4, 1507-16 (1959) July. (In Russian)

A physicochemical analysis was made of $LaCl_3$ complexed with gluconic acid. The influence of pH on the component ratio and concentration conditions were studied. (R.V.J.)

19931

TETRAHYDRATE OF STRONTIUM DIBORATE $SrB_2O_4 \cdot 4H_2O$. Ya. K. Ozol and A. F. Ievin'sh (Inst. of Chemistry, Academy of Sciences, Latvian S.S.R.). Zhur. Neorg. Khim. 4, 1587-9(1959) July. (In Russian)

A method is suggested for preparing strontium diborate, $SrB_2O_4 \cdot 4H_2O$, in the shape of well-defined crystals suitable for x-ray-diffraction analysis. Two modifications, mono- and tri-wedge, are exhibited simultaneously. Thermograms are plotted, and parameters of elementary crystal cells are determined. (R.V.J.)

19932

THE TERNARY SYSTEMS OF SODIUM AND POTASSIUM FLUORIDES, MOLYBDATES, AND TUNGSTATES AND THE BINARY $SiF-LiCrO_4$. Z. A. Mateĭko and G. A. Bukhalova. Zhur. Neorg. Khim. 4, 1649-52(1959) July. (In Russian)

A visual polythermal method was used in studies of $Na||F, MoO_4, WO_4$, and $K||F, MoO_4, WO_4$. NaF was synthesized at 993°C, Na_2MoO_4 at 688°C, K_2WO_4 at 926°C, Na_2WO_4 at 698°C, KF at 858°C, and K_2MoO_4 at 926°C. Crystallization diagrams are given. (R.V.J.)

19933

ON COMPOUNDS FORMED IN $UO_2(NO_3)_2-K_2CO_3-H_2O_2-H_2O$. E. V. Komarov, L. D. Preobrazhenskaya, and A. M. Gurevich. Zhur. Neorg. Khim. 4, 1667-73(1959) July. (In Russian)

The compounds of $UO_2(NO_3)_2-K_2CO_3-H_2O_2-H_2O$ with concentrations of 10^{-4} to 2×10^{-3} M and various other components were studied. The cryogenics and light absorption measurements identified compounds or complex ions of $H_2U_2O_8$, $[UO_2(CO_3)_2(OOH)]^{3-}$, $[UO_2(CO_3)(OO)]^{4-}$, and anions with two peroxide groups per uranium atom. The spectrophotometric data showed the $UO_2(CO_3)_2(OOH)^{3-} = H^+ + [(UO_2(CO_3)_2(OO)]^{4-}$ dissociation constant equal to about 2.5×10^{-11}. (R.V.J.)

19934

EQUILIBRIUM SYSTEMS OF $UO_2(IO_3)_2-KIO_3-H_2O$. A. E. Kalygin, I. D. Smirnova, and N. A. Nikol'skaya. Zhur. Neorg. Khim. 4, 1674-6(1959) July. (In Russian)

The solubility process in $UO_2(IO_3)_2-KIO_3-H_2O$ at $\mu = 0.2$ and 25 to 60° was determined. The dissociation constant of $UO_2(IO_3)_3^-$ in $UO_2(IO_3)_2$ was estimated. It was found that uranium precipitation as $UO_2(IO_3)_2$ cannot be accurately determined due to the high solubility. (R.V.J.)

19935

CHEMICAL DATA ON PROTACTINIUM. A. V. Nikolaev, A. G. Kurnakova, and Z. G. Rumyantseva. Zhur. Neorg. Khim. 4, 1682-6(1959) July. (In Russian)

A specimen of Pa^{233} was prepared by irradiating solid thorium nitrate (hydrated) for 20 hours. The half life is 27 days. Various experiments were carried out to determine the chemical behavior of protactinium in thorium, thorium chromates and salicylates, $MnO(OH)_2$, and $Fe(OH)_3^+$. Studies were also made of the behavior of protactinium during extraction by salicylosalicylic acid and acetone. (R.V.J.)

19936

ON THE VOLATILE HIGHER RUTHENIUM CHLORIDE. S. A. Shchukarev, N. I. Kolbin, and A. N. Ryabov (Zhdanov Leningrad State Univ.). Zhur. Neorg. Khim. 4, 1692-3(1959) July. (In Russian)

Studies of metallic ruthenium chlorination by gaseous chlorine at 400°C revealed a $RuCl_3$ amorphous film on the cooler walls. An assumption was made that a higher chloride forms in a $RuCl_3$–chloride reaction, followed by disintegration into $RuCl_3$ and Cl_2. In order to confirm the assumption, correlations were made of the volume of ruthenium carried from the combustion boat in chlorine and in nitrogen. (R.V.J.)

19937

ON THE FORMATION OF PENTAVALENT NEPTUNIUM COMPLEXES. Yu. A. Zolotov and Yu. P. Novikov (Vernadskii Inst. of Geochemistry and Analytical Chemistry, Academy of Sciences, U.S.S.R.). Zhur. Neorg. Khim. 4, 1693-7(1959) July. (In Russian)

The formation of NpO_2^+ complexes with tartaric, trioxyglutaric, citric, salicylic, 2, 3-dioxyterephthalic, acetic, phthalic, and ethylenediamine tetraacetic acids was determined by the variations in absorption spectra. (R.V.J.)

19938

X-RAY EMISSION SPECTROGRAPHIC ANALYSIS OF BASTNAESITE RARE EARTHS. Farrell W. Lytle, James I. Botsford, and Henry A. Heller (Bureau of Mines, Reno, Nevada). p.367-86 of "Proceedings [of the] Sixth Annual Conference on Industrial Applications of X-Ray Analysis, August 7-9, 1957, Denver, Colorado." William M. Mueller, ed. Denver, University of Denver, [1958]. 502p.

An x-ray emission spectrographic method of analysis is presented for the determination of rare earth elements in fractions obtained from bastnaesite ore. The method includes the determination of yttrium, thorium, lanthanum, and the rare earth elements in various complex mixtures. The analysis technique is based upon comparing the samples to synthetic standards approximating the composition of the samples. Working curves are plotted on an absolute intensity basis, with no correction for background. Examples of working curves and the analyses of typical rare earth concentrates are included. The selection of spectral lines for the various sample matrices is discussed. A special technique is used for samples in which rapid hydration and carbonation occurred. By analyzing synthetic samples of known composition, the accuracy of the method was determined. The error of analysis was about 3% of the amount present in the range from 5 to 100% and about 7% in the 0.2 to 5% range. A maximum

of about 40 samples per day may be analyzed for 7 elements each. The advantages and disadvantages of the method are discussed. (auth)

19939

DIRECT ASSAY FOR MOLYBDENUM AND RUTHENIUM IN URANIUM ALLOYS BY X-RAY EMISSION SPECTROMETRY. D. S. Flikkema and R. V. Schablaske (Argonne National Lab., Lemont, Ill.). p.387-98 of "Proceedings [of the] Sixth Annual Conference on Industrial Applications of X-Ray Analysis, August 7-9, 1957, Denver, Colorado." William M. Mueller, ed. Denver, University of Denver, [1958]. 502p.

It has been found possible to determine quickly the concentrations of molybdenum and ruthenium in nonradioactive alloys representative of high burn-up reactor fuels by the method of x-ray emission spectrometry. Preliminary steps of chemical dissolution and separation are not required. The alloys, essentially ternaries of molybdenum and ruthenium with uranium, are being studied because they are considered to typify the alloys which will result from cycling uranium fuel elements through the sequence of fabrication, use, and pyrometallurgical processing. The analytical procedure involves sampling of the ingot by slicing with a silicon carbide wheel at the plane of interest and reducing the surface to the flatness and finish obtained by a five-minute grinding and polishing operation. In the x-ray spectrograph the flat surface is examined for the intensities of its molybdenum and ruthenium K emission lines, with counting times of one to eight minutes. Calibration plots of intensity versus chemically determined weight per cent are established and used for subsequent sets of analyses. (auth)

19940

SOME COMMENTS ON THE BETA-EXCITED X-RAY SOURCE. Luther E. Preuss (Edsel B. Ford Inst. for Medical Research, Detroit). p.409-37 of "Proceedings [of the] Sixth Annual Conference on Industrial Applications of X-Ray Analysis, August 7-9, 1957, Denver, Colorado." William M. Mueller, ed. Denver, University of Denver, [1958]. 502p.

Studies have been made of the application of x-ray spectrography to continuous analysis for process control. To date the most widespread application of fluorescent x-ray spectrography to process control has been in measurement of plating thickness. Realizing that many other processes could use a method of continuous analysis of moving materials, these studies were undertaken. A modified tube housing and sample holder was constructed so that material could be passed through the x-ray beam of a conventional x-ray spectrograph at various linear speeds. Detectability versus material speeds were studied for a number of elements in various mediums. (auth)

19941

COMPARISON OF DESIGN AND OPERATION AT THE IDAHO CHEMICAL PROCESSING PLANT. Presented at Nuclear Engineering and Science Conference, April 6-9, 1959, Public Auditorium, Cleveland, Ohio. Preprint V-74. A. L. Ayers and F. Morgan Warzel (Phillips Petroleum Co., Idaho Falls, Idaho). New York, Engineers Joint Council, 1959. 40p. $0.50.

Design criteria are presented and compared to operating performance for several types of equipment used in a direct maintenance nuclear fuel reprocessing plant. (auth)

19942

REDKOZEMEL'NYYE ELEMENTY; POLUCHENIYE, ANALIZ, PRIMENENIYE. (Rare Earth Elements; Extraction, Analysis and Application). D. I. Ryabchikov, I. P. Alimarin, I. N. Zaozerskii, R. V. Koglyarov, V. I. Kuznetsov, M. M. Senyavin, and Yu. S. Sklyarenko, eds. Moscow, Izd-vo AN SSSR, 1958. 331p.

Reports presented at the June 1956 Conference on Rare Earth Elements at the Institute of Geochemistry and Analytical Chemistry of the Academy of Sciences USSR were collected. The articles treat chemical methods of separating rare earth mixtures, methods of processing rare earth ores, ion exchange chromatography, chemical analysis, and some industrial applications of rare earths. (auth)

19943

IMPROVED METHOD FOR THE PRODUCTION OF URANIUM. W. H. Cooke and J. W. C. Crawford (to UK Atomic Energy Authority). British Patent 804,064. Nuclear Eng. 4, 324(1959) July-Aug.-Sept.

To improve the economy of manufacture it is proposed to produce metallic uranium by the reduction of a uranium compound with a more electropositive metal carrying out the reduction in a reducing atmosphere and subsequently during the period when the melt cools to maintain an atmosphere of argon. A suitable method of production is reacting uranium tetrachloride or the double salt of uranium tetrachloride and sodium chloride with an alkali metal such as sodium or an alkaline earth metal such as calcium or magnesium, or with aluminum.

19944

PREPARATION OF HIGH PURITY LITHIUM CARBONATE FROM CRUDE AQUEOUS LITHIUM CHLORIDE. G. L. Canningham (to Chempatents, Inc.). British Patent 804,962. Nuclear Eng. 4, 324(1959) July-Aug.-Sept.

An aqueous solution containing from 15 to 30% lithium chloride together with a concentration of sodium chloride or potassium chloride, or both, is treated with sodium carbonate and heated to 95 to 100°C. Solid lithium carbonate is then separated from the heated mixture.

19945

TREATMENT OF AQUEOUS FISSION PRODUCT SOLUTIONS. T. W. Boyer, J. G. MacHutchin, and L. Yaffe. British Patent 805,361. Nuclear Eng. 4, 324(1959) July-Aug.-Sept.

Solutions after solvent treatment to extract the uranyl nitrate and the plutonium exhibit considerable radioactivity due to the presence of fission products. As these solutions usually comprise considerable volumes, the storage problem is serious. Therefore, it is proposed to treat the solution with a carboxylic acid anhydride, such as acetic anhydride, to react with and destroy the ammonium nitrate. Subsequently, the solution can be concentrated by evaporating the liquid resulting in the fission products remaining in a small volume of acetic anhydride-acetic acid mixture.

19946

PRODUCTION OF NIOBIUM AND TANTALUM COMPOUNDS. R. W. Blundell (to UK Atomic Energy Authority). British Patent 805,501. Nuclear Eng. 4, 324(1959) July-Aug.-Sept.

Niobium sources (ores and crude commercial products) usually contain tantalum and chemical extraction processes, therefore, yield niobium with an appreciable tantalum content. Extracting niobium and tantalum by

heating with potassium hydroxide and then separating potassium niobate and potassium tantalate from insoluble matter results in considerably less niobium and tantalum than are present in the source material. It has been found that the losses occur through the presence of iron in the source and these losses can be reduced if the formation of ferric hydroxide is avoided by performing the heating step under reducing conditions (in the presence of metallic iron) and if subsequently precautions are taken to avoid such formation while the hot alkaline potassium niobate and tantalate solution is in contact with the insoluble matter.

Radiation and Radiochemistry

19947 AECU-4289
Michigan. Univ., Ann Arbor.
ACTIVATION ANALYSIS OF TRACE COBALT IN TISSUE USING 10.5-MINUTE COBALT-60m. David G. Kaiser and W. Wayne Meinke. 1959. 13p. $3.30(ph), $2.40(mf) OTS.

Microgram amounts of cobalt from vitamin B-12 were analyzed by rapid activation analysis in rat kidney tissue as well as in vitamin preparations. A 15-minute radiochemical separation procedure coupled with gamma-ray spectrometry permitted utilization of the 10.5-min Co^{60m} radioisotope. With this procedure the lower limit of detection at a thermal neutron flux of 10^{12} n/cm^2 sec was about 5×10^{-9} grams of cobalt. (auth)

19948 CEA-tr-A-578
NOUVEAUX PROCÉDÉS DE DÉTECTION PHOTOGRAPHIQUE DES INDICATEURS RADIOACTIFS CONTENUS DANS DES SUPPORTS NON RADIOACTIFS. (New Procedures for the Photographic Detection of Radioactive Indicators Contained in Non-Radioactive Supports.) Hans-Joachim Kirschning. Translated into French from Atomkernenergie 2, 245-8(1957). 13p.

The techniques and apparatus used for the photographic detection of radioactive tracers are discussed. The beta microscope, constructed by Shapland et al., is described, and its disadvantages are tabulated. A detailed description is given of the design and construction of a beta microscope which allows the study of a sample with low activity and the direct observation of kinetic phenomena. (J.S.R.)

19949 CEA-tr-A-582
LA MESURE DES SUBSTANCES RADIOACTIVES DANS L'EAU PAR LA METHODE DISCONTINUE. (Measurement of Radioactive Substances in Water by the Discontinuous Method.) R. Neuwirth. Translated into French from Atompraxis 3, 402-4(1957). 12p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 3557.

19950 CEA-tr-R-235
RÉACTIONS CONJUGUÉES PENDANT L'ACTION DU RAYONNEMENT γ SUR LES SOLUTIONS AQUEUSES DU COLORANT BLEU DE METHYLENE. (Coupled Reactions During the Action of γ Radiation on Aqueous Solutions of Methylene Blue.) A. I. Chernova (Thernova), V. D. Orekhov, and M. A. Proskurnin (Proskournine). Translated into French by [B.] de Trezvinsky from Zhur. Fiz. Khim. 30, 1343-8(1956). 14p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 11 as abstract No. 962.

19951 CEA-tr-R-655
ENRICHISSEMENT EN RADIO-ISOTOPES D'ANTIMOINE À L'AIDE DU TRIPHENYLDIFLUORANTIMOINE PAR LA MÉTHODE DES ATOMES DE RECUL. (Enrichment in the Radioisotopes of Antimony with the Aid of Diphenylstibine Difluoride by the Method of Recoil Atoms.) V. D. Nefedov and L. N. Evtikheev. Translated into French by B. Vinogradoff from Zhur. Fiz. Khim. 30, 2090-2(1956). 9p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 11, as abstract No. 1975.

19952 CEA-tr-R-657
SORPTION DES ISOTOPES RADIOACTIFS PAR L'HYDROXYDE D'ALUMINIUM. (Sorption of Radioactive Isotopes by Aluminum Hydroxide.) S. A. Voznesenskii, V. V. Pushkarev (Poushkarev), and V. (B.) F. Bagretsov. Translated into French by B. de Trezvinsky from Zhur. Neorg. Khim. 3, 235-9 (1958). 14p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 13848.

19953 CEA-tr-R-669
ENRICHISSEMENT DU MERCURE EN ISOTOPES RADIOACTIFS. (Enrichment of Mercury in Radioactive Isotopes.) V. D. Nefedov, E. N. Sinotova, and V. I. Katsapov. Translated into French by B. Vinogradoff from Zhur. Fiz. Khim. 30, 1867-70(1956). 9p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 11, as abstract No. 1974.

19954 CEA-tr-R-699
RECHERCHES DANS LE DOMAINE DES COMPOSÉS MARQUÉS AU ^{14}C ET ^{15}N. IX. SYNTHÈSE DES ACIDES ^{15}N-AMINÉS. (Investigations in the Area of Compounds Labeled with C^{14} and N^{15}. IX. Synthesis of Aminoacids-N^{15}.) V. I. Maimind, O. M. Eniscberlova, K. M. Ermolaev (Ermolayev), R. G. Vdovina, G. A. Galedov, and M. M. Shemiakin (Shemiakine). Translated into French by B. Vinogradoff from Zhur. Obshchei Khim. 28, 2223-8(1958). 14p.

The results of investigations on the conditions and methods for the synthesis of lysine-6-N^{15} and ornithine-5-N^{15} are given. The synthesis of lysine-6-N^{15} was attempted with the aid of 5-(δ-phthaloylaminobutyl)-hydantoin and with 5-(δ-phthaloylaminobutyl)-3-phenylhydantoin. The synthesis of ornithine-5-N^{15} was attempted with α,ω-diphthaloylaminopropyl malonic acid, 5-(4-phthaloylaminopropyl)-3-phenylhydantoin, and the diethyl ether of α-acetylamino-ω-phthaloylaminopropylmalonic acid. (J.S.R.)

19955 CEA-tr-R-703
SÉPARATION DU TECHNÉTIUM-99m SANS ENTRAÎNEUR PAR LA MÉTHODE DE RUPTURE DE LA LIAISON CHIMIQUE LORS DE LA DÉSINTÉGRATION β. (Separation of Carrier-Free Technetium-99m by the Method of Chemical Bond Breaking During β Disintegration.) V. D. Nefedov and M. A. Toropova. Translated into French from Zhur. Neorg. Khim. 3, 231-4(1958). 11p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 13842.

19956
THE RESISTIVITY OF BOILING NITROGEN UNDER

IRRADIATION IN A REACTOR. Yu. K. Gus'kov and A. V. Zvonarev. Atomnaya Energ. 7, 165–6(1959). Aug. (In Russian)

The resistivity of liquid nitrogen irradiated in a reactor was measured in order to determine electrical properties of substances irradiated in it. The resistivity after irradiation by 1.5×10^{13} neutron/cm^2/sec was $<10^{10}$ ohms/m. The resistivity in a reactor neutron flux and 10^{11} γ/cm^2/sec is reduced to 10^{12} ohms/cm^3; with 1.5×10^{13} γ/cm^2/sec it is 4×10^9 ohms/cm^3. With total evaporation of nitrogen the resistivity drops to 7×10^7 ohms/cm^3. The relationship between resistivity changes and the magnitude of the irradiation is close to linear. Deviation from linearity is caused by the increase of vapors in the boiling nitrogen. During material irradiation in nitrogen, it is important to consider the mean vapor content in the media and the distribution of the vapor content in relation to the examined material. (R.V.J.)

19957

PARAMAGNETISM OF RADIOACTIVE SOLUTIONS. V. M. Vdovenko and V. A. Shcherbakov (Khlopen Radium Inst., Academy of Sciences, U.S.S.R.). Doklady Akad. Nauk S.S.S.R. 127, 127–30(1959) July 1. (In Russian)

The magnetic properties of aqueous solutions irradiated by dissolved or isolated β and γ radioactive isotopes and the magnitudes of their effects on the water proton spin-lattice relaxation time T are studied. T is the parameter which under certain conditions determines the intensity of magnetic signals. The results of observations made with various isotopes (Cd^{115}, $Eu^{152, 154}$, Na^{24}, S^{35}, Sr^{89}, and Zr^{95}) are tabulated. (R.V.J.)

19958

X-RAY ABSORPTION K SPECTRA OF VANADIUM IN SOME HYDRIDES, CARBIDES, NITRIDES AND BORIDES. E. A. Zhurakovskii and E. E. Vainshtein (Vernadskii Inst. of Geochemistry and Analytical Chemistry, Academy of Sciences, U.S.S.R.). Doklady Akad. Nauk S.S.S.R. 127, 534–6(1959) July 21. (In Russian)

Correlations were made of the x-ray K$^-$ absorption spectra of vanadium in metal, pentoxide, two carbides (with 16 and 19% C), nitride, boride in diboride, and in a group of hydrides with 0.1 to 1.25 wt. % H held in a furnace from 30 to 240 min at various temperatures. (R.V.J.)

19959

QUANTITATIVE CONTROL OF THE PRODUCTS OBTAINED IN DRESSING BERYLLIUM AND FLUORITE ORES BY α-BOMBARDMENT. I. N. Plaksin, V. N. Smirnov, and L. P. Starchik. Doklady Akad. Nauk S.S.S.R. 127, 618–19(1959) July 21. (In Russian)

Nuclear reactions $Be^9_4 + He^4_2 \rightarrow C^{12}_6 + n^1_0$ and $F^{19}_9 + He^4_2 \rightarrow Na^{22}_{11} + n^1_0$ were applied in quantitative determinations of concentrations in beryllium and fluorite ores enriched by α ray irradiation. The nuclear yield in reactions (α,n) for beryllium is 80 neutrons and for fluorite 12 neutrons per 10^6 α particles while for other elements in the beryllium and fluorite ores the yield of neutrons is considerably smaller (0.74 for Al, 0.11 for C, 0.07 for O, and 0.16 for Si). Consequently, in the enriched beryllium and fluorite the number of neutrons knocked out by α particles should be proportional to the beryllium and fluorite content. Po^{210} was used as the source. Graduate graphs plotted for a synthetic mixture of beryllium with quartz and feldspar (quartz–feldspar ratio 2:1) show that ~14% of beryllium oxide knocked out by α particles is in direct proportion with the beryllium content; for the mixture of fluorite with quartz and barite (quartz–barite ratio 5:2) the content of fluorite was determined in the enriched and in the original products. The method is sufficiently accurate for determining the content of beryllium and fluorite in enriched ores and can, also, be used for determining boron. (R.V.J.)

19960

RADIOELEMENTS IN CRYSTALLINE SUBSTANCES. I. E. Starik (Khlopin Radium Inst., Academy of Sciences, U.S.S.R.). Izvest. Akad. Nauk S.S.S.R., Otdel. Khim. Nauk No. 6, 955–62(1959) June. (In Russian)

A method of "comparative" leaching and emanation was applied for determining microquantities of decay products. It is shown that the separation of materials and decay products (Th and RdTh, U I and U II, Pb, and RaD) can be explained by their crystal lattice position. The weaker leaching ability of RdTh in comparison to ThX (Ra^{224}) results from its higher adsorptive property. The data obtained on radioelement content in natural waters is in complete agreement with the developed concept on radioelement migration. The results obtained on migration from minerals can be applied to the state of radioelements in artificially prepared salts. (R.V.J.)

19961

EFFECT OF HARD X-RAYS ON KI–KIO_3–H_2O–$CHCl_3$ SYSTEM. A. K. Pikaev and P. Ya. Glazunov (Inst. of Physical Chemistry, Academy of Sciences, U.S.S.R.). Izvest. Akad. Nauk S.S.S.R., Otdel. Khim. Nauk No. 6, 1137–9(1959) June. (In Russian)

The effects of hard x rays on hydrous solutions of potassium iodate and iodide saturated by chlorine containing hydrocarbon and the yield of iodine under x irradiation were determined. In trichloroethylene iodide–iodate saturation, the iodine yield is far below that without $CHCl_3$. In two phase systems, with an increased ratio of $CHCl_3$, the yield of iodine increases. (R.V.J.)

19962

EFFECT OF NEUTRON IRRADIATION ON THE ACTIVITY OF SILICA–ALUMINA CATALYST FOR THE DOUBLE BOND ISOMERIZATION OF BUTENE-1. P. J. Lucchesi, D. L. Baeder, J. P. Longwell, and M. C. Schroeder (Esso Research and Engineering Co., Linden, N. J.). J. Chem. Phys. 31, 558–9(1959) Aug.

X-ray and electron diffraction studies on irradiated and unirradiated samples showed no detectable differences. Catalytic tests designed to measure the conversion of butene-1 to cis and trans butene-2 in flow experiments at 150°F and atmospheric pressure show a 40% decrease in the catalytic activity of the irradiated sample. (C.J.G.)

19963

ELECTRON BOMBARDMENT OF SOLID ACETONE. Erwin M. Hörl (National Bureau of Standards, Washington, D. C.). J. Chem. Phys. 31, 564–5(1959) Aug.

From these observations was noted the intensity decrease of the fluorescent light during the irradiation and recovery process at higher temperatures (77°K). These new features are explained. (C.J.G.)

19964

STRUCTURE OF THYMINE HYDROPEROXIDE PRODUCED BY X-IRRADIATION. B. Ekert and R. Monier (Pasteur de l'Institut du Radium, Paris). Nature 184, 58–9(1959) Sept. 5.

X irradiation of aerated aqueous solutions of nucleic

acids, pyrimidine nucleotides, or pyrimidine bases was found to give rise to hydroperoxides. The irradiation of thyamine was observed to produce two forms, or hydroperoxides I trans and I cis. The structure of these compounds is presented. (C.H.)

19965

DEGRADATION OF THIOTAURINE BY IONIZING RADIATIONS. D. Cavallini, B. Mondovi, B. Giovanella, and C. De Marco (Univ. of Modena Univ. of Rome and Regina Elena Inst. for Cancer Research, Rome). Nature 184, 61(1959) Sept. 5.

Thiotaurine (aminoethylthiosulphonate) was discovered as a metabolic product of cystine and cystamine in the rate. Results are reported from a study of its degradation by x and gamma rays. (C.H.)

19966

"K-20,000." V. A. Gol'din. Nauka i Zhizn. 25, No. 12, p. 17, p. 2 of centerfold (1958).

An installation for irradiation-chemical research is described. The source of radiation is cobalt with an activity of approximately 20,000 g-equivalent of radium. A detailed description of the apparatus (using a colored schematic drawing) is given, and its advantages for conducting research are listed. (TCO)

19967

CERIC DOSIMETRY: ACCURATE MEASUREMENTS AT 10^8 RADS. J. T. Harlan and Edwin J. Hart (Argonne National Lab., Lemont, Ill.). Nucleonics 17, No. 8, 102; 107-11(1959) Aug.

Ceric solution concentrations from 0.0 to 0.39 M when subjected to doses of 10^8 rads are presented in dosimeter curves. Non-linearity of the dosimeter curve is exhibited by 0.39 M ceric sulfate. In 0.39 M ceric sulfate, solution $G(Ce^{3+})$ increases to 3.1. An opposite reaction occurs when the cerous concentration becomes high near complete depletion of ceric ions. (C.J.G.)

19968

CERIC DOSIMETRY: ROUTINE USE AT 10^5–10^7 RADS. Samuel I. Taimuty, L. H. Towle, and D. L. Peterson (Stanford Research Inst., Menlo Park, Calif.). Nucleonics 17, No. 8, 103-5; 107(1959) Aug.

Response is linear with properly selected solutions. Precision of ±1% is possible with great care. Average G-value from measurements was $G(Ce^{3+}) = 2.50 \pm 0.04$, which within experimental error is constant below 35°C. Ceric-ion concentrations ranging from 0.001 to 0.05 M are satisfactory. (C.J.G.)

19969

PRODUCTS THAT ARE FORMED BY HEATING AT VARIOUS TEMPERATURES CALCIUM PHOSPHATE AND THORIUM PHOSPHATE. Carlo Bettinali (Università, Rome and C.N.R.N., Rome). Ricarca sci. 29, 1535-7(1959) July. (In Italian)

Thorium phosphate reacts with calcium phosphate at a temperature higher than 500°C to form thorium oxide and calcium pyrophosphate. The formation of the metaphosphate is also possible. This reaction explains why all the attempts to synthesize apatite by means of high temperature reactions, with tetravalent elements in isomorphous substitution with calcium, as with U^{4+}, leads to the formation of the oxide of the element. (J.S.R.)

19970

PREPARATION OF Cs^{131} AND Ge^{71}. Franco Salvetti (Università, Rome). Ricarca sci. 29, 1546-8(1959) July. (In Italian)

The methods of preparing Cs^{131} and Ge^{71} with the maximum chemical and radiochemical purity were studied. The reactions of slow neutrons with natural barium and germanium are tabulated. The best results were obtained with an ion exchange method. (J.S.R.)

19971

RESEARCH ON COMPLEXING IN SOLUTIONS BY THE DISTRIBUTION METHOD. THE SYSTEM: SELENOYL-2-ACETONE-Th(IV)–$CHCl_3$–H_2O. V. M. Peshkova and A. P. Zozulya (Lomonosov Moscow State Univ.). Zhur. Anal. Khim. 14, 411-16(1959) July-Aug.

Selenenoyl-2-acetone is much more suitable for the extraction of thorium from water solutions than acetylacetone widely used for this purpose. The stability constants of thorium selenenoyl-2-acetonates and the distribution constant of the extracted complex in the $CHCl_3$ — H_2O system, have higher values than those of the acetylacetonate complexes. (auth)

19972

EXTRACTION-PHOTOMETRIC DETERMINATION OF THORIUM IN NATURAL MATERIALS. L. I. Gerkhardt. Zhur. Anal. Khim. 14, 434-9(1959) July-Aug.

Conditions were studied for separating thorium from accompanying elements by extraction of thorium phenylcinchonate with n-butanol at pH 2.5 to 4.5 in the presence of ascorbic acid. The possibility of photometering the thorium complex with arsenazo in the presence of tartaric and ascorbic acid, in the medium acetone—butanol—water, was established. An extraction-photometric method was developed for the determination 0.005 up to whole parts % of thorium with arsenazo in ores and minerals from a small sample. The relative error is 5 to 20%. (auth)

19973

COMPLEXOMETRIC AND PHOTOMETRIC DETERMINATION OF THORIUM IN MINERALS AND ORES. F. V. Zaikovskii. Zhur. Anal. Khim. 14, 440-4(1959) July-Aug.

Complexometric titration of thorium in solutions containing calcium, zirconium, titanium, and rare earths with the use of $Fe(SCN)_3$ as an indicator was studied. A titrimetric method was developed for determining thorium in natural materials containing large amounts of zirconium and titanium with the use of iodate and oxalate precipitation, as well as a colorimetric end-point, when small quantities of thorium are determined with arsenazo. The determination of thorium by these methods takes 8 to 12 hours. (auth)

19974

SPECTROPHOTOMETRIC STUDY OF URANIUM SOLUTIONS. COMMUNICATION 2. A SPECTROPHOTOMETRIC METHOD FOR THE DETERMINATION OF URANIUM IN ORES AND OTHER MATERIALS AS THIOCYANATE AFTER EXTRACTION WITH METHYLETHYLCETONE. S. I. Sinyakova and N. S. Klassova (Vernadskii Inst. of Geochemistry and Analytical Chemistry, Academy of Sciences U.S.S.R.). Zhur. Anal. Khim. 14, 451-6(1959) July-Aug.

Conditions were determined for the spectrophotometric determination of uranium as a thiocyanate complex (after the extraction of uranium nitrate with methylethylcetone) in samples containing Fe, Cu, Co, V, Mo, and other elements. The method permits the determination of 0.01 to 1.0% of uranium in ores (and other materials). The relative error is ± 2 to 3%. (auth)

19975

TITRIMETRIC DETERMINATION OF URANIUM BY THE FLUORIDE METHOD. V. M. Zvenigorodskaya

and M. I. Ryanicheva. Zhur. Anal. Khim. 14, 457-62 (1959) July-Aug.

A titrimetric method was developed for determining uranium in the presence of iron, vanadium, molybdenum, and titanium. The method is based on the reduction of uranium(VI) with bivalent iron in sulfuric acid in the presence of hydrofluoric acid; tetravalent uranium is precipitated as the sodium bifluoride, $NaUF_5$. Uranium is determined vanadatometrically. (auth)

19976

THE EFFECT OF γ-RADIATION OF Co^{60} ON THE WATER VAPOR PERMEABILITY OF POLYETHYLENE. K. V. Chmutov and E. E. Finkel (Inst. of Physical Chemistry, Academy of Sciences, U.S.S.R.). Zhur. Fiz. Khim. 33, 1648-52(1959). (In Russian)

The dependence of the vapor permeability of polyethylene films on the γ-radiation dosage from Co^{60} was studied over the dosage range from 46 to 299 million roentgens. Determination of the vapor permeability was made with the aid of tritium-labeled water. The coefficient of diffusion of water vapors in polyethylene was found to fall somewhat with increased in the irradiation dosage in air, whereas the solubility and permeability coefficients greatly increase. The fall in the diffusion coefficient with increase in the radiation dosage is explained by the transition of the polyethylene from partially crystalline to an amorphous state and by the increase in density of the polyethylene from formation of cross linkages. The considerable increase in solubility of the water vapor in polyethylene results from the formation of polar groups within it from radiolysis by γ radiation. The increase in permeability of the polyethylene for water vapor after the action of the γ radiation is associated with growth in solubility. (auth)

19977

RADIATION INDUCED REACTIONS OF ISOPROPYL ETHER IN AQUEOUS SOLUTION. V. V. Saraeva and N. S. Kolosova (Lomonosov Moscow State Univ.). Zhur. Fiz. Khim. 33, 1774-9(1959) Aug. (In Russian)

The action of x rays on isopropyl ether in aqueous solution was studied in the presence of different gases. In an N_2-saturated solution the products observed were acetone and alcohol; in the presence of O_2, hydrogen peroxide was also formed. In the presence of H_2, only acetone could be detected, the yield being the lowest in the presence of oxygen. The results obtained lead to the conclusion that the reactivity of the HO_2 radical towards the isopropyl ether molecule is less than that of H and OH. The absence of alcohol in the H_2-saturated solutions shows that the reaction $H_2 + OH \rightarrow H_2O + H$ proceeds with relatively high velocity. In the presence of oxygen, hydrogen peroxide is first formed and then decomposes with the production of additional acetone. The decomposition is due to reaction with H and C_3H_7 radicals. (auth)

Separation Processes for Pu and U

19978 AECU-4304

Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.

A STUDY OF EQUILIBRIA INVOLVED BETWEEN DAREX OFF-GASES AND SOLUTIONS. Annual Report No. 1 [for] December 1, 1958 through July 31, 1959. Clyde Orr, Jr., Margaret C. Kordecki, J. K. Gladden, and Clyde T. Young. 39p. Project No. A-427. For Oak Ridge National Lab. Contract W-7405-eng-26, Subcontract No. 1373. $6.30(ph), $3.00(mf) OTS.

In the Darex process, aqua regia is used to dissolve the materials of spent reactor fuel elements. For economic reasons, it is desirable to recover the off-gases from the dissolving process, especially the chlorine, in acid solutions that can be recycled in the system. This project was undertaken to develop a method of analyzing the off-gases and to determine their solubility in various concentrations of hydrochloric acid, nitric acid, and aqua regia at several temperatures. Work was concentrated on the development of a precise method for the quantitative analysis of gaseous mixtures containing some or all of the following gases: NO, N_2O, $NO_2(N_2O_4)$, NOCl, HCl, Cl_2, and water vapor. The initial emphasis was placed on gas chromatography, but no combination of columns and conditions was found by which accurate results for all these gases could be obtained. Analyses by spectrophotometric methods appeared at first to be unsatisfactory because of the masking by NO_2 and Cl_2 in the visible and the ultraviolet range, the absorption by water in the infrared region, and the absence of absorption by Cl_2 in the infrared region. Experiments have now shown, however, that water vapor does not entirely mask the other components. A complete analysis can be accomplished if, after the gaseous mixture has been scanned with an infrared spectrophotometer, the separation of chlorine is effected by dissolving the mixture in CCl_4 and shaking it with water. Only the chlorine remains in the CCl_4 layer and can be analyzed spectrophotometrically in the ultraviolet or visible region. Preliminary experiments of this type have shown how the gases from aqua regia at atmospheric pressure vary with time. Samples taken 20 minutes after mixing showed the presence of HCl in the gas phase and gave an indication of some water vapor. Samples taken after 70, 120, and 205 minutes did not reveal HCl but gave progressively larger NOCl peaks and showed a yellow color, indicating the presence of chlorine. After 48 hours the sample peaks were essentially the same as those from the 205-minute sample. (auth)

19979 AECU-4319

Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.

A STUDY OF EQUILIBRIA INVOLVED BETWEEN DAREX OFF-GASES AND SOLUTIONS. A LITERATURE SURVEY ON THE SOLUBILITY OF ARGON, CHLORINE, HYDROGEN CHLORIDE, NITRIC OXIDE, NITROGEN, NITROGEN DIOXIDE, NITROUS OXIDE AND OXYGEN IN WATER, NITRIC ACID, HYDROCHLORIC ACID AND AQUA REGIA. Special Report No. 1. Thomas W. Wilson. June 1, 1959. 107p. For Oak Ridge National Lab. Contract W-7405-eng-26, Subcontract 1973. $16.80(ph), $5.70(mf) OTS.

A literature survey on the solubilities of Ar, Cl, H, chlorides, nitrogen oxides, N, and O in various liquids such as H_2O, HNO_3, aqueous HCl, and aqua regia was conducted. The findings are tabulated. References reviewed include Applied Science and Technology Index, 1958, Chemical Abstracts, 1937 to Feb. 1959, Engineering Index, 1958, and The Industrial Arts Index, 1955 to 1957. 117 references. (J.R.D.)

19980 ANL-6017

Argonne National Lab., Lemont, Ill.

EXTRACTION OF URANIUM, MAGNESIUM, ZIRCONIUM, AND CERIUM FROM BISMUTH WITH A FUSED

FLUORIDE SALT MIXTURE. Max D. Adams, Jack Fischer, Robert J. Meyer, and Norman D. Phillips. June 1959. 19p. $0.75(OTS).

The extraction of uranium, magnesium, cerium, zirconium, and niobium from bismuth with a molten mixture of sodium fluoride and zirconium fluoride was demonstrated. Comparative rates of extraction were obtained. The effects of high concentrations of magnesium and of hydrogen fluoride sparging on the extraction process were investigated. Tracer studies demonstrated that exchange occurs between zirconium dissolved in the bismuth and zirconium in the fused salt. The applicability of the fused fluoride extraction step to the processing of the "Liquid Metal Fuel Reactor" solution fuel is discussed. (auth)

19981 ANL-6023
Argonne National Lab., Lemont, Ill.
PRELIMINARY REPORT ON CONVERSION OF URANIUM HEXAFLUORIDE TO URANIUM DIOXIDE IN A ONE-STEP FLUID-BED PROCESS. I. E. Knudsen, N. M. Levitz, and S. Lawroski. Aug. 1959. 15p. Contract W-31-109-eng-38. $0.50(OTS).

A one-step, continuous, fluid-bed process for the conversion of uranium hexafluoride to uranium dioxide was successfully carried out in preliminary experiments in a $1\frac{1}{2}$-inch-diameter Monel reactor. Hydrogen and steam were used for simultaneous reduction and pyrohydrolysis reactions carried out at 600°C, resulting in the formation of a dense coating of dioxide on the starting bed of uranium dioxide. The effects of uranium hexafluoride feed rate and reactant excesses on conversion were investigated. Results of fluid-bed steam pyrohydrolysis runs on uranium tetrafluoride are also presented. (auth)

19982 CF-59-8-73
Oak Ridge National Lab., Tenn.
REPROCESSING OF ARE FUEL, VOLATILITY PILOT PLANT RUNS E-3 THROUGH E-6. C. L. Whitmarsh. Aug. 26, 1959. 39p. $6.30(ph), $3.00(mf) OTS.

Reprocessing of the ARE fuel was resumed after extensive leak testing in the pilot plant. This was considered necessary to assure no recurrence of gaseous UF_6 leaks as experienced in Run E-2. In the four additional runs required to complete the program, about 641 kg of fluoride salt containing 40.64 kg of fully enriched uranium was reprocessed. Recovery as UF_6 product represented 97.97% of the feed, with 0.01% measured losses. An additional 2.14% was reclaimed from NaF beds. The product was of sufficient purity to meet specifications for material designated for reduction to uranium metal. Decontamination from fission products was essentially complete. Calculations based on the entire ARE program indicated 96.38% product recovery, with 0.06% measured losses. An additional 2.50% was reclaimed from NaF beds and equipment washes. (auth)

19983 DP-393
Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Aiken, S. C.
REPROCESSING OF POWER REACTOR FUELS. Quarterly Progress Report No. 6 [for] January 1 to April 1, 1959. Edward S. Occhipinti, comp. June 1959. 11p. Contract AT(07-2)-1. $0.50(OTS).

Welds of 309SCb corrode at a rate much faster than that of the wrought metal in boiling $HF-HNO_3$ systems, although the weld and wrought metal corrode at about equal rates in HF alone. When a 309SCb dissolver is used for processing Detroit-Edison core elements, a satisfactory alternative to dissolving in HNO_3 containing a low concentration of HF is to remove the cladding of zirconium with dilute HF, and then to dissolve the core alloy (10% Mo–90% U) by addition of HNO_3 containing a small amount of $Al(NO_3)_3$ to complex free fluoride. (For preceding period see DP-338.) (auth)

19984 IDO-14478
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
SALT-PHASE CHLORINATION OF REACTOR FUELS. I. DISSOLUTION OF ZIRCONIUM ALLOYS IN LEAD CHLORIDE. H. T. Hahn and E. M. Vander Wall. May 22, 1959. 23p. Contract AT(10-1)-205. $0.75 (OTS).

Dissolution of zirconium-based fuel elements by a salt-phase chlorination process is proposed. Scoping experiments show that lead chloride rapidly dissolves zirconium, Zircaloy-2, and uranium-zirconium alloys; that zirconium tetrachloride readily volatizes from the melt; and that uranium loss by volatility can be reduced to a negligible amount. Salient advantages offered by the ARCO (Alloy Reguline Chloride Oxidation) process include early separation of matrix material simultaneously with dissolution, reduction in size of final uranium decontamination equipment, and compact waste storage. (auth)

19985 MLM-M-167
Monsanto Chemical Co., Dayton, Ohio.
THE TELLURIUM PROCESS: I. APPLICATION TO SOLUTIONS OF BOMBARDED BISMUTH. II. APPLICATION TO EXTRACTS OF RESIDUES FROM RADIOACTIVE LEAD DIOXIDE. Final Report No. 36. C. L. Rollinson, P. M. Hamilton, and J. W. Schulte. June 26, 1947. Decl. July 14, 1959. 114p. $18.30(ph), $6.00 (mf) OTS.

Processes for obtaining Po concentrates suitable for electrodeposition from aqua regia solutions of Po and Bi were investigated. The steps of the process include denitration with formaldehyde, coprecipitation of Te and Po by reduction with stannous chloride, separation of Ag as Ag ammine ion, separation of Te by reduction with N_2H_4, and conversion of the resulting HCl solution of Po to a HNO_3 concentrate. Application of the process to extracts of radioactive PbO_2 residues is also described. (J.R.D.)

19986 NAA-SR-3591
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
REMOVAL OF IRRADIATED UO_2 FUEL FROM THE CLADDING BY CONTROLLED OXIDATION. L. A. Hanson. Aug. 1, 1959. 26p. Contract AT-11-1-GEN-8. $0.75(OTS).

A method using remote operations for removing irradiated UO_2 fuel from the zircaloy cladding has been investigated. The oxidation reaction of UO_2 to U_3O_8 accomplishes pellet and particle breakup by an increase in lattice dimension, and the oxidized sample falls from the cladding. Removal rate vs. temperature curves have been plotted for both air flow and oxygen flow. Optimum removal rate was obtained at 620 ± 10°C with oxygen and at 560 ± 10°C with air as the flow gas. The removal rate with oxygen is more than twice the rate obtained with air flow. This process indicates promise as a scaleup operation because of the simplicity of essential apparatus and of the techniques involved. (auth)

19987 NP-7834
European Company for the Chemical Processing of Irradiated Fuels, Mol, Belgium.
SAFETY HAZARDS CONSIDERATIONS. Technical Report No. 45, Chapter 500. H. H. Ph. Moeken and J. J. H. Alderhout. 22p. $4.80(ph), $2.70(mf) OTS.

The effects of an emergency release of radioactive materials from the Eurochemic plant into local ground water or the atmosphere were evaluated. Leakage from liquid waste tanks is considered as well as atmospheric contamination by I^{131} escape. Credible accidents are analyzed, and recommendations concerning equipment and procedures are made. (J.R.D.)

19988 NP-7846
European Company for the Chemical Processing of Irradiated Fuels, Mol, Belgium.
THE SITE: PRELIMINARY REPORT ON SOIL AND UNDERGROUND WATER INVESTIGATION. Technical Report 44, Chapter 300. E. Lüscher. [1959]. 22p. $4.80(ph), $2.70(mf) OTS.

The general underground structure, soil properties, and underground water movement were investigated. Various data resulting from test hole drilling are tabulated, and comments on topographic and geologic aspects are included. Maps and diagrams are also included. (J.R.D.)

19989 NP-7862
European Company for the Chemical Processing of Irradiated Fuels, Mol, Belgium.
INSTRUMENTATION: PRINCIPLES, SPECIFICATIONS, FLOW SHEETS, DATA SHEETS, ELECTRICAL EQUIPMENT. Technical Report No. 53, Chapter 220. R. Winckler. 1959. 35p. $9.30(ph), $3.60(mf) OTS.

Instrumentation for the Chemical Processing Plant at Mol for irradiated fuel is considered in terms of principles of operation, specifications for equipment, flow sheets, data sheets, and electrical equipment. The highest possible reliability is required for the instrumentation. This point of view is more important than the accuracy of instruments. Detailed drawings and flow sheets are given. (W.D.M.)

19990 NP-7866
European Company for the Chemical Processing of Irradiated Fuels, Mol, Belgium.
CHEMICAL PROCESS FLOWSHEETS. Technical Report No. 49, Chapter 140. E. Detilleux, M. Lang, E. L. Nicholson, and A. Redon. [1959]. 55p. $12.30 (ph), $4.50(mf) OTS.

The chemical aspects of the Eurochemic radiochemical processing plant are discussed in detail. Material and activity balances for the two alternative processes of 700 and 350 kg per day are presented. Flowsheets for head end, extraction, tail-end treatments, solvent recovery, and acid recovery are presented. (W.L.H.)

19991 NP-7867
European Company for the Chemical Processing of Irradiated Fuels, Mol, Belgium.
LAYOUT PRINCIPLES OF MAIN PLANT BUILDING. Technical Report No. 46, Chapter 400. E. Lüscher. [1959]. 3p. $1.80(ph), $1.80(mf) OTS.

A sketch is presented of a radiochemical processing plant building which will contain a crane gallery on top of the processing cells, a control and operating room with a connecting cable and pipe room, the analytical laboratory, a sampling corridor, access and utility corridors, a large ventilation hall, a makeup area, decontamination facilities, health physics facilities, an assembly hall, product storage room, and some offices. Adjacent to the process building are arranged the fuel receiving and storage facilities near the head-end cells and the maintenance workshops in proximity to the assembly hall. (W.L.H.)

19992 NP-7868
European Company for the Chemical Processing of Irradiated Fuels, Mol, Belgium.
ROUTINE ANALYTICAL LABORATORY REQUIREMENTS. Technical Report No. 36, Chapter 410. K. Samsahl and W. Schüller. [1959]. 11p. $3.30(ph), $2.40(mf) OTS.

Analytical methods, frequency of analysis, and working time required for routine analysis of the Eurochemic plant are summarized. Polarography was used in the uranium determination of plutonium-rich samples, and coulometry was used for determining uranium in the end product. Specific data on solvent recovery and acid recovery analysis which are necessary for the design of analytical laboratories are given. A total of 30 people will suffice for routine analytical work during the initial period. Approximately 20 to 25 of the 30 people required will not need any education in chemistry. (C.J.G.)

19993 NP-7869
European Company for the Chemical Processing of Irradiated Fuels, Mol, Belgium.
SITE DEVELOPMENT. BUILDING ARRANGEMENTS. Technical Report No. 43, Chapter 310. E. Lüscher. [1959]. 4p. $1.80(ph), $1.80(mf) OTS.

The situation of the site and arrangement of the buildings are described. Scale drawings are included. (J.R.D.)

19994 NP-7870
European Company for the Chemical Processing of Irradiated Fuels, Mol, Belgium.
DRAWING STANDARDS FOR EQUIPMENT AND INSTRUMENT FLOWSHEETS. Technical Report No. 39, Chapter 200. O. Jenne and R. Winckler. [nd]. 13p. $3.30(ph), $2.40(mf) OTS.

Drawing standards for equipment and instrument flowsheets are presented for a radiochemical processing plant. Symbols to define pipelines and armatures are presented. All major items of equipment will be identified by letters, indicating the type of equipment or instrument and consecutive numbers starting at one for each plant section. The instrument type will be identified by two or three letters. (W.L.H.)

19995 NP-7872
European Company for the Chemical Processing of Irradiated Fuels, Mol, Belgium.
FUEL ELEMENT INVESTIGATION COMPILATION OF DATA. Report ED-C Rev., Chapter 110. 1959. 24p. $4.80(ph), $2.70(mf) OTS.

A compilation of fuel element data from Austria, Belgium, Denmark, France, Germany, Italy, Netherlands, Norway, Portugal, Spain, Sweden, and Switzerland is presented. Comments concerning production plans for each country are included. (J.R.D.)

19996 NP-7881
European Company for the Chemical Processing of Irradiated Fuels, Mol, Belgium.
CHEMICAL ENGINEERING. Technical Report No. 41, Chapter 210. 1959. 10p. Appendix includes 37 drawings. $93.60(ph), $11.10(mf) OTS.

Engineering flowsheets for a future reprocessing plant were prepared in a preliminary form for two

alternative projects. The first flowsheet is for a production development plant capable of processing 100 tons per year of fuel elements of natural or slightly enriched U. The second flowsheet is for a pilot plant with a capacity of 350 kg per day of natural U fuel. The flowsheets comprise the main stages of the processing operation. (W.L.H.)

19997 CEA-tr-X-144

EXTRACTION DU NITRATE D'URANYLE AU MOYEN DU TBP (TRIBUTYL PHOSPHATE). EXTRACTION DES SELS MINÉRAUX CONTENUS DANS LA SOLUTION D'ACIDE NITRIQUE. (Extraction of Uranyl Nitrate with TBP (Tributyl Phosphate). Extraction of Mineral Salts Contained in the Nitric Acid Solution.) Taichi Sato and Totaro Goto. Translated into French by E. Hara from Kôgyô Kagaku Zasshi 60, 1444-7(1957). 17p.

A study was made to determine the best conditions for the extraction of uranyl nitrate with TBP. Nitric acid was used as the salting-out agent. The effects of diluents for the TBP on the extraction process was first determined. The variation of the extraction rate was determined as a function of the TBP concentration with respect to the quantity of diluent added. The experimental results showed that extraction efficiency is best when kerosene is used to dilute the TBP and when the ratio of kerosene to TBP is 8:2. Under these conditions the solubility of water in the solvent is quite small. The effects of the nitric acid concentration, uranyl nitrate concentration, and extraction temperature on the extraction coefficient were determined. The effects of coexistent ions were also studied. An aqueous solution of uranyl nitrate was extracted with 20% TBP and 6M nitric acid at a temperature less than 20°C. The uranyl nitrate concentration was below 10 g/l, and an extraction coefficient of more than 97% was obtained. The extraction mechanism for these conditions is discussed. (J.S.R.)

19998 CEA-tr-X-145

SEPARATION PAR RECUL DES ÉLÉMENTS LOURDS TELS QUE L'URANIUM ET LE NEPTUNIUM D'AVEC LEURS PRODUITS DE FISSION. (Recoil Separation of Heavy Elements Such as Uranium and Neptunium from their Fission Products.) T. Nakai and S. Yajima. Translated into French by S. S. Minn from Nippon Kagaku Zasshi 79, 1267-8(1958). 8p.

A study was made of the efficiency of the recoil method for the separation of uranium from its fission products. In the first test powdered uranium oxide, U_3O_8, was mixed with powdered oxalic acid and irradiated. The sample was dissolved in ammonia and filtered. The uranium fission products were carried with the oxalic acid and separated from the undissolved uranium oxide. In a similar test the uranium oxide was mixed with graphite. After irradiation a zinc bromide solution was added to the sample and the mixture centrifuged. The graphite contained most of the activity. In a third investigation the uranium oxide–graphite mixture was boiled in nitric acid and the undissolved graphite removed by filtration. The results showed that the fission products were captured by the graphite. (J.S.R.)

19999

EXTRACTION OF NITRIC ACID BY DERIVATIVES OF BUTYLPHOSPHINIC ACIDS. A. V. Nikolaev, S. M. Shubina, and N. M. Sinitsyn (Kurnakov Inst. of General and Inorganic Chemistry, Academy of Sciences, U.S.S.R.). Doklady Akad. Nauk S.S.S.R. 127, 578-80 (1959) July 21. (In Russian)

Data are presented on the extraction properties of butylphosphoric compounds of tributylphosphate $(C_4H_9O)_3$ PO, dibutyl ether butylphosphine acid $(C_4H_9O)_2$ C_4H_9 PO, butyl ether dibutylphosphine acid (C_4H_9O) $(C_4H_9)_2$ PO, and tributylphosphinoxide $(C_4H_9)_3$ PO. The nitric acid distribution relation to the concentration of the extractive reagent and the uranyl nitrate in the solution was investigated. (R.V.J.)

20000

THE CONCENTRATION OF URANIUM-235: SURVEY OF MOST IMPORTANT METHODS AND PRINCIPLES. F. I. Havliček (Institute J. Stefan, Ljubljana, Yugoslavia). Energia nucleare (Milan) 6, 521-31(1959) Aug. (In Italian)

Diffusion, physical-chemistry, and electromagnetic methods for the separation of uranium isotopes are reviewed. An account is given of the principles on which each is based, a critical examination is made of the possibilities they offer, and a number of experimental devices are described. (auth)

20001

REVIEW OF DEVELOPMENTS IN REPROCESSING OF IRRADIATED NUCLEAR FUELS BY PYROMETALLURGICAL METHODS. Presented at Nuclear Engineering and Science Conference, April 6-9, 1959, Public Auditorium, Cleveland, Ohio. Preprint V–50. L. F. Coleman, J. H. Schraidt, and G. J. Bernstein (Argonne National Lab., Lemont, Ill.). New York, Engineers Joint Council, 1959. 29p. $0.50.

Results of experimental programs indicate the problems and promises of pyrometallurgical methods for reprocessing irradiated nuclear fuels. The processes of melt refining, solvent extraction by fused salts and liquid metals, and fractional crystallization from metal solvents, being developed are discussed. (auth)

20002

PRODUCTION OF PURE URANIUM HEXAFLUORIDE FROM ORE CONCENTRATES. Presented at Nuclear Engineering and Science Conference, April 6-9, 1959, Public Auditorium, Cleveland, Ohio. Preprint V–52. W. C. Ruch, D. A. Peterson, E. A. Gaskill, and H. G. Tepp (Allied Chemical Corp., New York). New York, Engineers Joint Council, 1959. 31p. $0.50.

Equipment design and operating criteria are presented for the new Allied Chemical uranium hexafluoride production facilities employing newly developed processing methods. Uranium hexafluoride is produced by direct reduction, hydrofluorination, and fluorination of ore concentrates in fluid bed reactors and purified by fractional distillation. (auth)

20003

DESIGN vs. PERFORMANCE OF PROCESS AND EQUIPMENT IN A LARGE-SCALE RADIOCHEMICAL SEPARATIONS PLANT. Presented at Nuclear Engineering and Science Conference, April 6-9, 1959, Public Auditorium, Cleveland, Ohio. Preprint V-71. A. W. Joyce, Jr., L. C. Peery, and E. B. Sheldon (Du Pont de Nemours (E. I.) & Co., Aiken, S. C.). New York, Engineers Joint Council, 1959. 37p. $0.50.

The primary plutonium separations system at the Savannah River Plant employs the Purex tributyl phosphate solvent extraction process in heavily-shielded remotely-maintained facilities. Process and equipment performance are referenced to the design bases with regard to product quality, yields, maintenance experi-

ence, and process hazards, within the limits of security regulations. (auth)

20004

DESIGN AND OPERATING CONSIDERATIONS FOR OFF-GAS SYSTEMS IN NUCLEAR PROCESSING PLANTS. Presented at Nuclear Engineering and Science Conference, April 6-9, 1959, Public Auditorium, Cleveland, Ohio. Preprint V-72. Lloyd R. Michels (General Electric Co., Richland, Wash.). New York, Engineers Joint Council, 1959, 29p. $0.50.

Highlights of integrated facilities for the control of air-borne radio-iodine and fission product particulate material at the Hanford Purex Plant are presented. Design and operating information is provided on improved silver reactors, fibrous glass filters, auxiliary iodine and nitric acid absorbers and improved nitric acid rectification equipment. (auth)

20005

AN EVALUATION OF THE DESIGN AND PERFORMANCE OF THE THOREX PILOT PLANT. Presented at Nuclear Engineering and Science Conference, April 6-9, 1959, Public Auditorium, Cleveland, Ohio. Preprint V-73. W. R. Winsbro and G. S. Sadowski (Oak Ridge National Lab., Tenn.). New York, Engineers Joint Council, 1959. 33p. $0.50.

This paper discusses plant and equipment utilized for pilot plant development of the Thorex process. Included are plant layout, selection of materials of construction, welding criteria, and testing and inspection procedures. Selection criteria and performance of radive process equipment and instrumentation are evaluated. (auth)

20006

PROCESS FOR EFFECTING A SELF-SUSTAINING NUCLEAR FISSION REACTION BY MEANS OF NEUTRONS. (to Stichting Reactor Centrum Nederland (Netherlands)). British Patent 804,787. Nuclear Eng. 4, 324(1959) July-Aug.-Sept.

This patent refers to the processing of fuels in a circulating liquid suspension. Fission products are removed from the fuel suspension by adding solid particles of low neutron-absorption capacity, which in the suspension will adsorb fission products liberated into the carrier liquid. These solid particles are added in such quantities that they have collectively an adsorption capacity considerably greater than that of the fissile particles in the suspension. The particles are continuously or periodically separated from the suspension and the removed particles replaced by further adsorbing particles. Owing to the high specific gravity of the fissile material (uranium oxide; thorium oxide) separation is conveniently effected by conducting at least part of the circulating suspension through a secondary circuit and a hydrocyclone which separates the suspension into two fractions. The fission products are separated in a filter and the carrier liquid free from solid matter returned to the suspension circuit. Carbon particles are preferred for adsorbing the fission products.

20007

METHOD OF SEPARATING PLUTONIUM. (to UK Atomic Energy Authority (U.S.A.)). British Patent 804,999. Nuclear Eng. 4, 324(1959) July-Aug.-Sept.

A vaporous mixture of the hexafluorides of uranium and plutonium is passed over a heated copper surface (100 to 455°C). Plutonium is removed through deposition on the copper.

20008

METHOD OF SEPARATING URANIUM. (to UK Atomic Energy Authority (Canada)). British Patent 805,001. Nuclear Eng. 4, 324(1959) July-Aug.-Sept.

The irradiated uranium metal is dissolved in concentrated nitric acid. The acidity is closely controlled and must not be above stoichiometric neutral in order to avoid extraction of plutonium together with the uranium. A salting out agent such as ammonium nitrate is then added to the solution and extraction is obtained by treating this solution with an organic solvent, preferably ethyl ether, which is sufficiently water-immiscible to form a separate phase and permit extraction of the uranyl nitrate without extracting the plutonium or other fission products at the same time. Details are given of a typical application resulting in 96.9% extraction of the uranyl nitrate with only 1.3% of plutonium and 0.09% of the fission products present in the original solution.

20009

SEPARATION OF PLUTONIUM. (to UK Atomic Energy Authority (Canada)). British Patent 805,302. Nuclear Eng. 4, 324(1959) July-Aug.-Sept.

The use of triglycoldichloride has been proposed as the non-aqueous solvent for a fractioning method in which the plutonium is extracted from aqueous nitrate solutions into a non-aqueous phase to uranium and/or fission products, which remain in the aqueous phase. It has been found that triglycoldichloride is much more effective when it has added to it a saturated aliphatic-aldehyde containing at least two carbon atoms per molecule, benzaldehyde, or a polyhydric phenol.

CONTROLLED THERMONUCLEAR PROCESSES

20010 NYO-8054

Princeton Univ., N. J. Project Matterhorn.

EQUILIBRIUM IN A TOROIDAL SYSTEM. Harold R. Koenig. Jan. 7, 1959. 70p. Contract AT(30-1)-1238. (PM-S-40). $2.00(OTS).

A stellarator shaped like a torus is analyzed under time invariant conditions, first with zero plasma pressure, and then with plasma pressure small compared with maximum magnetic pressure. (auth)

20011 SCTM-213-59(12)

Sandia Corp., Albuquerque, N. Mex.

IGNITRON FIRING. Floyd M. Stolt. Aug. 15, 1959. 12p. $0.50(OTS).

Information regarding ignitron firing circuitry is reported. The theory of cathode spot formation and arc mechanism is also discussed. Triggering methods are examined with regard to jitter and delay in arc formation and the interaction of the anode and ignitor circuits is illustrated by an equation which defines the capability of a firing system. (auth)

20012 UCRL-5599

California. Univ., Livermore. Lawrence Radiation Lab.

THE HARD-CORE PINCH. [PART] I. D. H. Birdsall, S. A. Colgate, and H. P. Furth. July 31, 1959. 13p. Contract W-7405-eng-48. $3.30(ph), $2.40(mf) OTS.

It is well known that a pinch column with internal H_z and external conducting shell can be made grossly stable, but that small-scale instabilities persist; especially in the tubular region of maximum current density. To investigate further these small-scale instabilities of the "stabilized pinch," we are using

12-in.-i.d. linear pinch tube with a 3-in.-o.d. insulated center rod. By controlling a current along this rod, as well as a current along external conducting straps, and a third current in an external H_z coil, it is possible to create many grossly stable pinch configurations. The small-scale stability of the tubular region of maximum current density can thus be studied for a wide range of internal and external magnetic field vectors. The magnetic field distribution in each discharge is obtained by a string of 10 magnetic pick-up loops. The distribution of plasma density is determined by modulating the inner or outer wall current and measuring the radial velocity of the resultant compressional Alfvén waves. In one experiment, an initial H_z is entrapped in plasma by preionization, and then pushed radially outward from the rod by a rising H_θ. The resultant field distribution, in which H_θ everywhere falls more rapidly than $1/r$, should have absolute hydromagnetic stability. The persistence of small-scale instabilities, as observed by the magnetic probes, in this "inverse stabilized pinch" suggests that the basic trouble is nonhydromagnetic. It is also found that, when the magnetic field approximates a vacuum field distribution, perfectly smooth and reproducible probe signals can be obtained. The absolute plasma current densities at which near-vacuum field distributions have been found stable are larger than current densities at which the "stabilized pinch" and inverse stabilized pinch" distributions have been found unstable. (auth)

20013 UCRL-5602

California. Univ., Livermore. Lawrence Radiation Lab.

THE HARD-CORE PINCH. [PART] II. D. H. Birdsall, S. A. Colgate, and H. P. Furth. July 31, 1959. 15p. Contract W-7405-eng-48. $3.30(ph), $2.40(mf) OTS.

The toroidal version of the hard-core pinch tube is created by levitating a ring conductor inside a toroidal shell. The magnitude of induced H_θ necessary for levitation is small in terms of field strengths normally desired for energetic pinches. In a 3-in. glass-and-copper toroid of square cross section, a $\frac{3}{4}$-in. hollow copper ring has been levitated with a 60-cycle current of 3 kiloamperes. A 12-in. stainless steel tube of round cross section is being built. The stability of near-vacuum field hard-core configurations is best investigated in toroidal geometry. At high power levels and low plasma densities, the conventional toroidal "stabilized pinch" is subject to an anomalous plasma energy leakage to the wall, which cannot be explained by the observed ultraviolet radiation alone. A critical question is, therefore, whether the relative stability of some hard-core pinches, as reflected by the smoothness and reproducibility of magnetic probe traces, is reflected by an improved containment of the plasma energy leading to high temperature. A toroidal hard-core tube is also useful in studying the nature of the nonhydromagnetic instabilities observed in the linear "inverse stabilized pinch." The presence and condition of electrodes appear to have a substantial effect on the magnitude of these instabilities, as would be expected if they were, for instance, of electrostatic origin. In order to complement the plasma study of the hard-core pinch, we have developed an analogue method using sodium tubes to simulate the current-carrying layer. In this way the purely hydromagnetic aspect of the plasma behavior can be isolated. (auth)

20014 AEC-tr-3697

REMARKS ON THE UTILIZATION OF ACCELERATED PARTICLE BEAMS FOR THE FORMATION OF PLASMAS. (Remarques sur l'Utilisation des Faisceaux de Particules Acceleres pour la Formation des Plasmas.) F. Prevot. Translated for Oak Ridge National Lab. from CEA Report PA-7523, Mar. 11, 1958. 10p. $4.80 (ph), $2.70(mf) JCL.

It is natural to think of utilizing particle accelerator beams of high intensity and convenient energy as a means of obtaining very hot and dense plasmas. The inconveniences and difficulties of this method are partially defined. The advantages inherent in such a method are pointed out. Problems summarized include the production of intense and dense ion beams with reduced energy, the injection and accumulation of ions in a restricted space, and the stability of the apparatus for a sufficient period of time. (W.D.M.)

20015

AN INTRODUCTION TO THERMONUCLEAR RESEARCH. A SERIES OF LECTURES GIVEN IN 1955. Albert Simon. International Series of Monographs on Nuclear Energy. Division XIV. Plasma Physics and Thermonuclear Research. Volume 1. New York, Pergamon Press, 1959. 191p. $5.50.

The material presented is based in part on a series of lectures given at ORNL in the Fall of 1955 and is essentially contained in ORNL-2285. The basic problems of controlled thermonuclear research are presented for the technical reader with no plasma physics background. Conditions for successful controlled thermonuclear reactions are discussed and leading approaches to fusion are indicated. (W.D.M.)

CRITICALITY STUDIES

20016 RFP-123

Dow Chemical Co. Rocky Flats Plant, Denver.

PLUTONIUM GRAPHITE ASSEMBLIES. A. Goodwin, Jr., and C. L. Schuske. Sept. 29, 1958. Decl. July 24, 1959. 25p. Contract AT(29-1)-1106. $3.30(ph), $2.40(mf) OTS.

Neutron multiplication measurements and theoretical calculations were made on cylindrical assemblies of graphite and plutonium disks. (auth)

GEOLOGY AND MINERALOGY

20017 AEC-tr-3795

SOIL AERATION—MEASURING TECHNOLOGY AND RESULTS. (Bodenatmung—Messtechnik und Ergebnisse.) Max Diem. Translated for Oak Ridge National Lab. from Gerlands Beitr. Geophys. 51, 146-66(1937). 48p. (Includes original, 22p.). $6.30(ph), $3.00(mf) JCL.

In order to understand soil aeration, i.e., the volume of air which flows through the earth's surface, a new measuring and recording method has been developed. The possible sources of error are investigated in detail. Three types of sand are measured in simplified experiments, and the result is found that no relation exists between soil aeration and pore volume. Open country measurements permit the recognition of the importance of soil aeration for agrarian meteorology. (auth)

20018

CESIUM-137 IN THE COASTAL WATERS OF JAPAN. Noboru Yamagata and Shunji Matsuda (Gunma Univ.,

Kiriu, Japan). Bull. Chem. Soc. Japan 32, 497-502 (1959) May.

The cesium-137 concentration in bittern and carnallites taken from various coastal waters from 1956 to 1958 was determined. (C.J.G.)

20019

GEOLOGY OF URANIUM DEPOSITS IN TRIASSIC ROCKS OF THE COLORADO PLATEAU REGION. W. I. Finch. U. S. Geol. Survey Bull. 1074-D. 1959. 44p., 3 illus.

Most of the uranium ore in the Triassic rocks of the Colorado Plateau occurs in channels or lenses of the Shinarump and Moss Back members of the Chinle formation. In general the deposits are tabular and follow the bedding; they range in size from a few tons to hundreds of thousands of tons. Although some of the deposits are mined only for uranium, others contain important amounts of vanadium or copper. The larger vanadium-uranium deposits generally contain about three times as much vanadium as uranium. The ore minerals are disseminated in rock, and commonly replace carbonaceous material and interstitial cement. The deposits in the Morrison formation of Jurassic age and the Triassic rocks have more points of similarity than of dissimilarity. The results of this study indicate that three belts, comprising about 20% of the area underlain by potentially ore-bearing Triassic rocks, are especially likely to contain significant deposits. Each belt of favorable ground was delineated on the basis of the distribution of channel systems along the pinchout of ore-bearing beds, geologic guides to ore, and rather widely scattered ore deposits of significant size. Although only three favorable belts have been outlined, it may be possible with further study to outline others, including known areas of favorable ground whose boundaries have not yet been traced. (auth)

20020

GÉOLOGIE DE L'URANIUM. (Geology of Uranium.) Marcel Roubault. Paris, Masson et Cie, 1958. 473p.

A detailed survey is presented of uranium minerals, prospection techniques, and known uranium deposits. In the first section of the book uranium minerals are described in detail, and the prospection of radioactive minerals is considered. The properties of combined uranium and thorium ores are also discussed in the first section. The second part presents detailed descriptions of the known uranium deposits of the world. The third section tabulates the reserves of uranium and thorium. An appendix discusses the mineralogy and prospection of thorium ores. (J.S.R.)

HEALTH AND SAFETY

20021 AECU-4138(App.B)

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

SCAVENGING OF PARTICULATE MATTER IN CONNECTION WITH NUCLEAR-POWERED SHIPS. Scientific Report No. 1. THEORETICAL DISSERTATION ON DIFFUSION AND DEPOSITION OF RADIOACTIVE PARTICULATE MATTER IN CONNECTION WITH NUCLEAR-POWERED SHIPS. Appendix B: GRAPHS OF SHAPE VARIABLES AND AREA AS A FUNCTION OF DIFFUSION PARAMETERS AND VELOCITY OF DEPOSITION. Jan. 24, 1958. 69p. ARF Project No. C119. Contract AT(11-1)-586. $10.80(ph), $3.90(mf) OTS.

20022 AERE-R-2952

United Kingdom Atomic Energy Authority. Research Group. Chemistry Div., Woolwich Outstation, England.

ALPHA ACTIVITY ON AIR FILTER SAMPLES COLLECTED AFTER THE WINDSCALE INCIDENT. R. N. Crooks, K. M. Glover, J. W. Haynes, R. G. Osmond, and F. J. G. Rogers. July 1959. 16p. $0.35(BIS).

Following a communication from the Danish Atomic Energy Commission reporting an increase in α activity on air filter samples taken after the Windscale incident of October 1957, a number of samples collected at various points on the Windscale site together with one from the Continent were analyzed for activity both by radiochemical and by direct pulse-height methods. One year after the incident the proportion of Pu^{239} was rather less than 2% of the total α activity, which corresponds to a proportion of 0.1 to 0.3% at the time of the incident assuming that the major portion of the activity was due to Po^{210}. Comparison between the two techniques used shows that direct α pulse height analysis on the filter paper usually provides an adequate identification and quantitative estimation of the activity. (auth)

20023 AERE-R-2970

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

STUDIES OF THE TOXICOLOGY OF PLUTONIUM. Katharine Williams. June 1959. 25p. $0.56(BIS).

Data are summarized from a survey of the literature covering the toxicity, retention, pathological effects, maximum permissible body burden, and maximum permissible values in air and water for plutonium. Fifty-six references. (C.H.)

20024 CLOR-1

Poland. Biuro Pelnomocnika Rzadu do Spraw Wykorzystania Energii Jadrowej. Centrale Laboratorium Ochrony Radiologicznej, Warsaw.

MEASUREMENTS OF TOTAL BETA ACTIVITY OF PLANTS IN POLAND DURING THE YEAR 1958. R. Szepke and D. Klarzyńska. Apr. 1959. 19p.

Measurements were made of total beta activity in plant samples collected from June to December, 1958. Results are presented from measurements on 245 samples of plants and plankton. Higher activity was found in the aerial parts of the plants than in the subterranean parts. Specific activities of the plant ashes are given, and data are compared with the magnitude of the fallout during the same time and the same area. (auth)

20025 CML-SR-M-124-7

Chicago. Univ. Chicago Midway Labs.

HIGH-ALTITUDE SAMPLING TECHNIQUES. Progress Report. July 1959. 9p. Contract AT(11-1)-508. $1.80(ph), $1.80(mf) OTS.

The fifth balloon flight to an altitude of 60,000 feet to collect stratospheric air samples for radiation analysis is described. (W.L.H.)

20026 HW-39433

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

A PROPOSED NUCLEAR SAFETY INDICATOR FOR CONTACT MAINTENANCE PURPOSES. G. M. Muller and N. Ketzlach. Oct. 10, 1955. Decl. Apr. 2, 1959. 3p. $1.80(ph), $1.80(mf) OTS.

An instrument is described which will make it possible to determine the safety of performing contact maintenance work on certain long columns used in the continuous flow processing of plutonium. Design, calibration, and use of the instrument are discussed. (C.J.G.)

20027 HW-58674

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

RADIOCHEMICAL ANALYSIS OF MARINE BIOLOGICAL SAMPLES FOLLOWING THE "REDWING" SHOT SERIES–1956. C. W. Thomas, D. L. Reid, and L. F. Lust. Dec. 29, 1958. 81p. Contract W-31-109-Eng-52. $13.80(ph), $4.80(mf) OTS.

The radionuclide spectrum was determined for marine biological specimens and sea water from the Western Pacific Ocean following the Redwing shot series of 1956. Sampling in the Caroline Islands extended for a one year period to determine both the time-activity relationship for the transport of radionuclide by oceanic currents and the translocation and maximum concentration of the radioisotopes. Absolute values were obtained for Pu^{239}, Zr^{95}-Nb^{95}, Ru^{103}-Ru^{106}, Zn^{65}, Co^{57}, Co^{58}, Co^{60}, Cs^{137}, Sr^{89}, Sr^{90}, Mn^{54} and the rare earth group for the widely divergent sample types. The outlined analytical methods utilized dry ashing technique, single and multi-channel gamma-ray spectrometry, sequential chemical separations, beta particle counting and alpha energy analysis. The methods were designed with a high degree of flexibility to simplify inclusion or exclusion of chemical separations. All isotopic and gross analytical data are appended including sensitivity values for radioisotopes below detectable concentrations. (auth)

20028 HW-60137

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

RESEARCH AND DEVELOPMENT ACTIVITIES IN THE FIELD OF RADIOLOGICAL SCIENCES. Quarterly Progress Report [for] January–March 1959. J. W. Healy, ed. Apr. 23, 1959. 36p. Contract W-31-109-Eng-52. $1.25(OTS).

Comparative studies of calcium and strontium metabolism and the influence of calcium content of the diet on strontium uptake indicate a lack of similarity in behavior between these two ions. Progress is reported in the following studies: the effect of strontium-90 and yttrium-90 on rainbow trout; the effects of the chronic ingestion of small doses of iodine-131 in sheep; the gastrointestinal absorption of orally administered strontium-90 in miniature swine; the effectiveness of various treatments in the therapy of radioinduced skin lesions; the absorption and metabolism of plutonium and the effects of DTPA on the deposition of plutonium in bone; the effects of the chronic ingestion of strontium-90 and calcium-45 in young rats; the effects of age on the absorption and retention of zinc-65 in rats; the long term effects of ingested yttrium-90 on the intestine; the radioprotective effects of erioglaucine in rats; the presence of lymphosarcomas in the intestinal mesentery of mice exposed to $Pu^{239}O_2$ atmosphere; the deposition and translocation of Pu^{239} following inhalation of $Pu^{239}O_2$ in dogs; the distribution of iodine-131 in sheep following exposure to iodine-131 vapor and silver iodide-iodine-131 aerosol; the radiosensitivity of yeast cells; the uptake of cesium-137 and strontium-90 by bean plants; a comparison of the quantities of the fission products, zirconium-niobium-95, cesium-137, cerium-141, and cesium-praseodymium-144 in plants and animals collected from various habitats with the amount of rainfall; the radiobiological monitoring of the Columbia River; modifications in personnel monitoring instruments; the completion of a whole-body monitor; the installation and testing of radiotelemetering equipment; investigations relative to detection techniques; a study of the process of adsorption and subsequent erosion of isotopes in reactor process tube film; geological and hydrological studies of the Hanford area of interest in problems of waste disposal; investigations on the immobilization of radioisotopes in waste solutions; the effectiveness of commercial anion exchange resins for removing plutonium from waste solutions; a review and analysis of information on fuel element rupture debris released to the Columbia River; and the release of fission products from heated low-level irradiated unclad uranium. (For preceding period see HW-58833.) (auth)

20029 M-7105

Department of Agriculture. Soil and Water Conservation Research Div., Beltsville, Md.

ACCUMULATION AND MOVEMENT OF FISSION PRODUCTS IN SOILS AND PLANTS. Quarterly Report for Period January–March 1957. Apr. 1957. 9p. $1.80(ph), $1.80(mf) OTS.

Data are tabulated on the strontium-90 content of samples of soil collected at various locations throughout the United States. Studies were carried out on the effects of soil type, calcium content, and rainfall and runoff on the strontium-90 concentration. Progress is reported in studies on the adsorption of strontium on clay and on cation exchange resin, the movement of strontium-89 in five different soil types, the foliar entry of strontium-89 and its subsequent translocation and accumulation within various plant tissues, and the accumulation of fission products on the leaves of garden vegetables. (C.H.)

20030 RISÖ-9

Denmark. Atomenergikommissionen. Forsögsinstitut, Risö.

ENVIRONMENTAL RADIOACTIVITY AT RISÖ, APRIL 1, 1958–MARCH 31, 1959. A. Aarkrog and J. Lippert. June 1959. 50p.

Measurements were made of the background radioactivity in the Risö Area during the period 1st April 1958 to 31st March 1959. The measurements include determination of β activity in a number of samples. Regular surveys have been carried out on sea-water, soil, air, bed-soil, eel, fresh water, rain water, grass, sea plants, and milk. In the case of grass, sea plants, and milk the natural potassium has been subtracted from the counting. Furthermore strontium-, cerium-, cesium- and yttrium-activity has been determined in a number of samples. A few α and γ measurements were done occasionally. (auth)

20031 TID-5555

Division of Biology and Medicine. Environmental Services Branch, AEC.

STRATOSPHERIC RADIOACTIVITY DATA OBTAINED BY BALLOON SAMPLING. Joshua Z. Holland. May 1959. 144p. $1.50(OTS).

In evaluating the possible hazard from Sr^{90} and other long-lived fission products, it has been established that stratospheric storage plays an important role. It then becomes necessary to know the content, distribution, and rate of removal of debris from the stratosphere.

indirect determinations of the content, based on assumed initial injections, are too uncertain and meteorological knowledge of stratospheric motions is too poor to satisfy questions on these subjects. One must rely on direct measurement of the stratosphere. It is evident that there are many uncertainties in the data collected in stratospheric sampling programs but that a potential exists for a valuable contribution, by good sampling and analysis, both to the Sr^{90} problem and to the meteorological problem of stratospheric transport, diffusion, and removal. The basic problems of particle size and filter efficiency have to be solved. It may be that an indirect method, such as comparison with aircraft or whole air collection, will be the only way to provide a solution to the calibration of the balloon sampling. In that event, a number of comparisons at various altitudes will be necessary to establish this calibration. It will also be necessary to perform these comparisons for each of the isotopes of interest. If the mechanical problems related to the collection of debris can be solved, the question of the quality of the radiochemical analyses becomes even more important. The large unexplained fluctuations in the ratios of the various isotopes suggest that much of the variability arises from this source. If it turns out that the variations observed in the past data are indeed real, then the four-station network sampling each altitude once a month now in existence would be inadequate. However, information presently available concerning the stratosphere suggests that the variations are improbable, especially when viewed in light of the estimate that most of the debris injected into the stratosphere before 1958, came from the Castle series in the Spring of 1954, three to four years prior to the measurements discussed. It is also possible that the relatively low stratospheric content indicated by the balloon data, and the decrease between 1957 and 1958, represents the best estimate, and that the models of injection and stratospheric-tropospheric exchange that have been employed are grossly in error. This would imply a much faster exchange than has been postulated or smaller initial injections or both. (auth)

20032 TID-7572

Puerto Rico. Univ., San Juan. School of Medicine and Division of International Affairs, AEC.
SYMPOSIUM ON HEALTH PHYSICS IN BIOLOGY AND MEDICINE, HELD AT THE UNIVERSITY OF PUERTO RICO SCHOOL OF MEDICINE, SAN JUAN, MAY 26-28, 1958. 220p. $2.00(OTS).

On May 26 through 28, 1958, the School of Medicine of the University of Puerto Rico was host to a Symposium on Health Physics in Biology and Medicine. This symposium brought together distinguished workers from Latin America and leading investigators from the continental United States for a bilingual symposium. Separate abstracts have been prepared on 17 scientific papers presented at this meeting. (C.H.)

20033 TID-7572(p.10-14)

Puerto Rico. Univ., Rio Piedras. Cosmic Ray Lab.
THE RADIOLOGICAL PHYSICS PROGRAM AT THE UNIVERSITY OF PUERTO RICO. Amador Cobas. p.10-14 of SYMPOSIUM ON HEALTH PHYSICS IN BIOLOGY AND MEDICINE, HELD AT THE UNIVERSITY OF PUERTO RICO SCHOOL OF MEDICINE, SAN JUAN, MAY 26-28, 1958. 5p.

Training and research activities in the field of radiological physics are reviewed. (C.H.)

20034 TID-7572(p.14-25)

Michigan. Univ., Ann Arbor.
HEALTH PHYSICS TRAINING. G. Hoyt Whipple. p.14-25 of SYMPOSIUM ON HEALTH PHYSICS IN BIOLOGY AND MEDICINE, HELD AT THE UNIVERSITY OF PUERTO RICO SCHOOL OF MEDICINE, SAN JUAN, MAY 26-28, 1958. 12p.

The responsibilities and qualifications of a professional health physicist are reviewed. Training programs are discussed. (C.H.)

20035 TID-7572(p.25-38)

National Bureau of Standards, Washington, D. C.
GENERAL PHILISOPHY OF HEALTH PHYSICS. Lauriston Taylor. p.25-28 of SYMPOSIUM ON HEALTH PHYSICS IN BIOLOGY AND MEDICINE, HELD AT THE UNIVERSITY OF PUERTO RICO SCHOOL OF MEDICINE, SAN JUAN, MAY 26-28, 1958. 14p.

The background of the problem of protection against the harmful effects of radiation is reviewed. A summary is presented of the criteria of the International Commission on Radiological Protection, the International Commission on Radiological Units and Measurements, and the U. S. National Committee on Radiation Protection and Measurement. Changes in these criteria during prior years are discussed. (C.H.)

20036 TID-7572(p.39-49)

Atomic Energy Commission, Washington, D. C.
IMPACT OF THE ATOMIC ENERGY ON THE COMMUNITY. Walter D. Claus. p.39-49 of SYMPOSIUM ON HEALTH PHYSICS IN BIOLOGY AND MEDICINE, HELD AT THE UNIVERSITY OF PUERTO RICO SCHOOL OF MEDICINE, SAN JUAN, MAY 26-28, 1958. 11p.

The impact of atomic energy on the community is discussed. Shifts in populations, the attraction of additional industries, ecological effects due to advent of large installations, sociological and economic effects, public health aspects, and psychological attitudes influencing public acceptance of atomic industry installations are considered. Conditions in communities in the United States are reviewed as illustrations. (C.H.)

20037 TID-7572(p.49-61)

Division of Biology and Medicine, AEC.
PROBLEMS IN THE THERAPY OF RADIATION SICKNESS. H. D. Bruner. p.49-61 of SYMPOSIUM ON HEALTH PHYSICS IN BIOLOGY AND MEDICINE, HELD AT THE UNIVERSITY OF PUERTO RICO SCHOOL OF MEDICINE, SAN JUAN, MAY 26-28, 1958. 13p.

It is pointed out that the status of the therapy of radiation sickness can be stated by saying there is no specific therapy for radiation sickness. There are a number of things which can be done, but these are in the nature of treatment rather than therapy in the true sense of the word. These treatments and the state of experimental research are reviewed. (C.H.)

20038 TID-7572(p.62-7)

Mimiya Hospital, Santurce, Puerto Rico.
RADIOISOTOPES IN PUERTO RICO. Roberto Busó. p.62-7 of SYMPOSIUM ON HEALTH PHYSICS IN BIOLOGY AND MEDICINE, HELD AT THE UNIVERSITY OF PUERTO RICO SCHOOL OF MEDICINE, SAN JUAN, MAY 26-28, 1958. 6p.

Clinical applications of radioisotopes are reviewed. Results are summarized from a number of studies of thyroid function employing iodine-131, radioiodine therapy in cases of hyperthyroidism, applications of radioiodine for the destruction of the thyroid gland in

patients with coronary insufficient and chronic passive congestion, applications of radioiodine in the therapy of malignant thyroid tumors, applications of chromium-51 to label red cells for studies of the function of the hematopoietic system, and studies of vitamin absorption using cobalt-60 labelled vitamin B_{12}. (C.H.)

20039 TID-7572(p.68-72)
Puerto Rico. Univ., San Juan. School of Medicine.
THE USE OF RADIOISOTOPES IN METABOLIC STUDIES. A. A. Cintrón Rivera. p.68-72 of SYMPOSIUM ON HEALTH PHYSICS IN BIOLOGY AND MEDICINE, HELD AT THE UNIVERSITY OF PUERTO RICO SCHOOL OF MEDICINE, SAN JUAN, MAY 26-28, 1958. 5p.

The basic requirements for the use of an isotope in animal or human experiments are outlined. Advantages of using labeled compounds in metabolic studies are reviewed. Techniques involving physiological localization of radioisotopes are discussed. (C.H.)

20040 TID-7572(p.72-91)
Oak Ridge Inst. of Nuclear Studies, Inc., Tenn.
MEDICAL PROBLEMS ENCOUNTERED IN THE HANDLING OF RADIOISOTOPES. Gould Andrews. p.72-91 of SYMPOSIUM ON HEALTH PHYSICS IN BIOLOGY AND MEDICINE, HELD AT THE UNIVERSITY OF PUERTO RICO SCHOOL OF MEDICINE, SAN JUAN, MAY 26-28, 1958. 20p.

The practicing physician dealing with radioisotopes should become familiar with the major problems as outlined by experts in health physics. He should then follow consistently a moderate, balanced program to deal with radiation hazards. In dealing with a clinical isotope program one may encounter four significant ranges of radiation exposure that can be applied to almost all types of internal and external radiation exposure. These are discussed from the point of view of the physician, other hospital employees, and the patient. Instruments used in radiation protection are described. Various shielding devices for use in a hospital using high-energy radioisotopes are described and illustrated photographically. It is concluded that if reasonable precautions are taken, radioisotopes can be used extensively without any serious practical danger to staff members. The hazard to patients is very small in diagnostic applications; hazard is greater but worth the risk in therapeutic use. The burden of maintaining a radiation protection program is not excessive, but it does require a consistent, intelligent effort. (C.H.)

20041 TID-7572(p.91-6)
Michigan. Univ., Ann Arbor.
THE VALUE OF TELETHERAPY IN CANCER. Isadore Lampe. p.91-6 of SYMPOSIUM ON HEALTH PHYSICS IN BIOLOGY AND MEDICINE, HELD AT THE UNIVERSITY OF PUERTO RICO SCHOOL OF MEDICINE, SAN JUAN, MAY 26-28, 1958. 6p.

Advantages of teletherapy isotope units include improved dosimetry, skin sparing effect, the ability to utilize small fields and still get adequate depth doses, the possibility of less late bone damage, increased technical precision and simplification, and increased patient tolerance. (C.H.)

20042 TID-7572(p.97-106)
Puerto Rico. Univ., Rio Piedras.
EXPERIENCE WITH COBALT-60 IN PUERTO RICO. Victor Marcial. p.97-106 of SYMPOSIUM ON HEALTH PHYSICS IN BIOLOGY AND MEDICINE, HELD AT THE UNIVERSITY OF PUERTO RICO SCHOOL OF MEDICINE, SAN JUAN, MAY 26-28, 1958. 10p.

Clinical experiences are summarized for the treatment of a great variety of cancer lesions with a cobalt-60 teletherapy unit. In 19 months 360 cases of cancer were treated. Higher tumor doses can be delivered than with conventional therapy. This form of therapy cannot be applied to all forms of cancer but was found to be of particular value in the treatment of cancer of the esophagus, bladder, tonsil, base of the tongue, nasopharynx, and other extensive lesions of the head and neck. (C.H.)

20043 TID-7572(p.106-14)
Argonne National Lab., Lemont, Ill.
HEALTH PHYSICS ASPECTS OF BASIC MEDICAL RESEARCH. William P. Norris. p.106-14 of SYMPOSIUM ON HEALTH PHYSICS IN BIOLOGY AND MEDICINE, HELD AT THE UNIVERSITY OF PUERTO RICO SCHOOL OF MEDICINE, SAN JUAN, MAY 26-28, 1958. 9p.

Facilities of the Argonne National Laboratory Biological and Medical Research Building are described. It is pointed out that except for primary contained radiation sources, large quantities of radioactivity are not ordinarily required in biological experiments. Major hazards to personnel need not exist with minimum facilities and reasonable precautions and attitudes. One should use the smallest possible amounts of radioactivity to be sure that experimental results are not complicated by radiation effects. Monitoring instruments should be of as high sensitivity as practicable. Experimental accuracy is constantly threatened by contamination. No amount of effort by a health physics representative can substitute for an informed approach and meticulous attention to detail on the part of the laboratory staff. (C.H.)

20044 TID-7572(p.114-40)
Tracerlab, Inc., Richmond, Calif.
HEALTH PHYSICS PROBLEMS ENCOUNTERED IN THE INDUSTRIAL USES OF RADIOISOTOPES. George G. Manov. p.114-40 of SYMPOSIUM ON HEALTH PHYSICS IN BIOLOGY AND MEDICINE, HELD AT THE UNIVERSITY OF PUERTO RICO SCHOOL OF MEDICINE, SAN JUAN, MAY 26-28, 1958. 27p.

Radiological physics problems which are encountered in the industrial uses of atomic energy and radioisotopes are reviewed. Technical, educational, legal, and budgetary problems encountered by industry are discussed. The engineering aspects of the utilization of atomic energy are mentioned briefly, and administrative and health physics problems are discussed in detail. (C.H.)

20045 TID-7572(p.141-59)
RADIATION DOSAGE RECEIVED BY THE GONADS DURING ROUTINE RADIOLOGICAL EXAMINATION. Mario Gaitán Yanguas. p.141-59 of SYMPOSIUM ON HEALTH PHYSICS IN BIOLOGY AND MEDICINE, HELD AT THE UNIVERSITY OF PUERTO RICO SCHOOL OF MEDICINE, SAN JUAN, MAY 26-28, 1958. 19p.

Results are reported from measurements of the radiation dose to the gonads received during routine radiological examinations. All measurements were made during daily routine work in hospitals. Results showed that many routine radiological examinations resulted in radiation dosages to the gonads. This dosage varied

according to the type of examination and technique employed. It is concluded that precautions should be taken by radiologists and their assistants to reduce the radiation dose to the gonads by every possible means. (C.H.)

20046 TID-7572(p.160-70)
Fundacioń Luís Roche. Instituto de Investigaciones Médicas, Caracas.
STUDIES ON THE PATHOPHYSIOLOGY OF HOOKWORM ANEMIA UTILIZING RADIOISOTOPES. Marcel Roche. p.160-70 of SYMPOSIUM ON HEALTH PHYSICS IN BIOLOGY AND MEDICINE, HELD AT THE UNIVERSITY OF PUERTO RICO SCHOOL OF MEDICINE, SAN JUAN, MAY 26-28, 1958. 11p.

Results are reported from a quantitative study of the various factors which affect the absorption of iron, the synthesis of red blood cells, and their ultimate fate in patients suffering from hookworm infection. Chromium-51 and iron-59 were used as tracers in the studies. (C.H.)

20047 TID-7572(p.171-89)
Division of Biology and Medicine, AEC.
THE ACTION OF RADIATION IN BIOLOGIC MATERIALS. H. D. Bruner. p.171-89 of SYMPOSIUM ON HEALTH PHYSICS IN BIOLOGY AND MEDICINE, HELD AT THE UNIVERSITY OF PUERTO RICO SCHOOL OF MEDICINE, SAN JUAN, MAY 26-28, 1958. 19p.

The nature and types of interactions which are found to occur between atoms and high-energy charged particles, neutrons, and x and gamma rays are reviewed. The action of ionizing radiation on water and chemicals, single cells, groups of cells, and organisms are discussed. Radiation injuries and the acute radiation syndrome in man are discussed in detail. (C.H.)

20048 TID-7572(p.190-201)
Puerto Rico. Univ., Rio Piedras.
THE PUERTO RICO NUCLEAR CENTER—ITS AIMS, ACTIVITIES AND PLANS. Charles F. Bonilla. p.190-201 of SYMPOSIUM ON HEALTH PHYSICS IN BIOLOGY AND MEDICINE, HELD AT THE UNIVERSITY OF PUERTO RICO SCHOOL OF MEDICINE, SAN JUAN, MAY 26-28, 1958. 12p.

The goal of the Puerto Rico Nuclear Center is to develop a comprehensive program for research and training in the Spanish language in nuclear science and engineering and in the peaceful applications of nuclear energy in medicine, agriculture, and industry. These objectives are reviewed and discussed. (C.H.)

20049 TID-7572(p.201-10)
Brookhaven National Lab., Upton, N. Y.
CLINICAL AND EXPERIMENTAL TESTING OF THE PRINCIPLES OF NEUTRON CAPTURE THERAPY. Lee Farr. p.201-10 of SYMPOSIUM ON HEALTH PHYSICS IN BIOLOGY AND MEDICINE, HELD AT THE UNIVERSITY OF PUERTO RICO SCHOOL OF MEDICINE, SAN JUAN, MAY 26-28, 1958. 10p.

The principles underlying neutron capture therapy are reviewed. Means of controlling boron toxicity are discussed. Clinical applications of neutron capture therapy using boron-10 as the capture element are described. Problems of dosimetry are discussed. (C.H.)

20050 TID-7577
Division of International Affairs, AEC.
SYMPOSIUM ON TECHNICAL METHODS IN HEALTH PHYSICS, RISÖ, DENMARK, MAY 25–28, 1959. 127p. $1.25(OTS).

Separate abstracts have been prepared on six papers presented at this symposium. (C.H.)

20051 TID-7577(p.1–25)
Argonne National Lab., Lemont, Ill.
THE USE OF LOW LEVEL SCINTILLATION SPECTROSCOPY IN THE EVALUATION OF RADIOACTIVE CONTAMINATION OF THE HUMAN BODY. C. E. Miller, H. A. May, and L. D. Marinelli. p.1–25 of SYMPOSIUM ON TECHNICAL METHODS IN HEALTH PHYSICS, RISÖ, DENMARK, MAY 25–28, 1959. 25p.

The use of NaI(Tl) scintillation spectroscopy has been extended successfully to the appraisal of the gamma radiation emitted by radioelements present in the human body, both in its normal state and in the presence of contamination levels well below those accepted as the maximum permissible under industrial exposure. Design criteria to be met by the detector and the shield of an instrument adequate for these purposes are discussed from theoretical and practical points of view. Special attention has been given to the analysis of the background spectrum as it is affected both by the natural radioactivity of the apparatus and its surroundings, and by the action of cosmic rays, ionizing particles, and showers. General and special measuring techniques, based on spectral analysis, are described in detail as they concern the localization, identification, and quantification of various radioelements either distributed throughout the whole body or localized in some of its organs. An outline is given of a coincidence summing technique capable of measuring, without recourse to chemical procedures, about 10^{-11} c of either the U^{238} or Th^{232} chain in equilibrium in the presence of potassium gamma-ray activities higher by three orders of magnitude. Possible uses of this technique are briefly mentioned. (auth)

20052 TID-7577(p.26–45)
Oak Ridge National Lab., Tenn.
THE SCIENTIFIC BASIS FOR MAXIMUM PERMISSIBLE LIMITS OF INTERNAL CONTAMINATION. Walter S. Snyder. p.26–45 of SYMPOSIUM ON TECHNICAL METHODS IN HEALTH PHYSICS, RISÖ, DENMARK, MAY 25–28, 1959. 20p.

Maximum limits of internal contamination depend on the conditions of exposure and also on the level of risk that is permitted. When possible, they are based on direct observation of the accumulation of the radionuclide in the body and of its effects on the body under similar conditions of exposure. For most radionuclides and for long-term chronic exposure, such data are not available, and the limit is set in terms of a maximum permissible dose rate to the various organs of the body. Such a limit is based on effects observed when the organ is irradiated at a similar level, either by another radionuclide or by external radiation, and on general experience with radiation effects at low levels of exposure. Some long-term data on the effect of radium in bone are known, and this is used to set the permissible level for radium and, by comparison of dose levels, for other radionuclides that deposit in bone. Clinical experiences with radiotherapy have provided considerable direct evidence of the effects of internal and external radiation on man. Laboratory experiments with animals have been the source of much relevant data but generally demand interpretation and revision for application to chronic exposure of man. The development of whole body counters has already provided some relevant data, particularly on retention of various isotopes and will doubtless be a tool of increasing importance in this work. Many of the data from the above sources are at dose levels considerably above those where the effects

are marginal or difficult to detect and thus must be reinterpreted. The background level of exposure may be considered to give a lower limit even for the exposure of the whole population. (auth)

20053 TID-7577(p.46–82)
Oak Ridge National Lab., Tenn.
IMMEDIATE EVALUATION OF DOSES FROM EXTERNAL RADIATION AND FROM INTERNAL CONTAMINATIONS IN THE EVENT OF A RADIATION ACCIDENT. Karl Z. Morgan. p.46–82 of SYMPOSIUM ON TECHNICAL METHODS IN HEALTH PHYSICS, RISÖ, DENMARK, MAY 25–28, 1959. 38p.

Two types of radiation exposure during accidents include exposure to external sources and exposure from internal sources. The first and most important consideration in radiation accidents is the prevention of such accidents. Appropriate training programs, the proper design and operation of buildings and facilities, and the effective functioning of an adequate health physics program cannot prevent all radiation accidents, but they can reduce the probability of their occurrence and can minimize their serious consequences. The second important consideration is early warning and immediate action when an accident happens. There is no doubt that the prompt exit of personnel during the Y-12 accident on June 16, 1958, and during the Argonne accident on June 2, 1952, prevented more serious consequences; and had there been similar retreat from the scene of the first two serious Los Alamos accidents (August 21, 1945, and May 21, 1946), there is reason to believe the human exposures would have been materially reduced, and perhaps the two fatalities could have been prevented. An important part of the prompt action during the period of a radiation accident is the immediate identification of the individuals who received high exposures. Several features of personnel monitoring meters enable one to make this identification. The third step in an accident is a careful estimate of the absorbed dose from the various types of radiation, i.e., from neutrons, gamma radiation, beta rays, etc., received by each of the accident victims. In addition, information should be obtained on the energy spectra of the radiation, the dose distribution throughout the body, and the dose rate. All these factors furnish information that is useful in determining the seriousness of the exposure and in deciding on the subsequent medical treatment. The absorbed dose information is obtained from the personnel monitoring meters, from area meters, from the activation of Na-24 and P-32 in the body, and from a study of the radiation source and the flight path of each of the exposure victims. The fourth and last step in a radiation accident is that of re-entry and cleanup. Sometimes these steps must be taken quickly but with considerable caution and forethought. For example, a critical assembly that resulted in the accident may go critical again with the slightest provocation, or in the case of a radium spill, cutting off or isolating part of the ventilation system may prevent serious human exposure and contamination resulting in a great financial loss. (auth)

20054 TID-7577(p.83–101)
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
CONFINEMENT TECHNIQUES AND HANDLING OF PLUTONIUM IN RESEARCH LABORATORIES. A. R. Keene. p.83–101 of SYMPOSIUM ON TECHNICAL METHODS IN HEALTH PHYSICS, RISÖ, DENMARK, MAY 25–28, 1959. 19p.

Plutonium with its extremely low maximum permissible body burden requires that some degree of confinement be provided in order to handle the material safely in research laboratories. Dependent upon the quantity and physical form of the material being handled, confinement techniques may range from complete physical isolation of the material from the research worker to nominal control through the use of standard survey procedures. Confinement and handling methods must consider the plutonium both as a source of external radiation and as a bone-seeker, potentially most likely to enter the body through accidental inhalation or skin injury. Other factors to be considered in establishing safe handling procedures include pyrophoricity of plutonium metal, required ventilation, use of strippable coatings, and survey techniques. A review of problems likely to be encountered when handling plutonium in research laboratories is made. (auth)

20055 TID-7577(p.102–9)
Los Alamos Scientific Lab., N. Mex.
CHEMICAL METHODS IN THE EVALUATION OF HUMAN CONTAMINATION. M. F. Milligan. p.102–9 of SYMPOSIUM ON TECHNICAL METHODS IN HEALTH PHYSICS, RISÖ, DENMARK, MAY 25–28, 1959. 8p.

Procedures and operations are pointed out for the radiochemical analysis of biological samples as a means of evaluating the internal radiocontamination of small worker populations or of individuals. The role of interpretation in evaluating the results is described. 46 references. (auth)

20056 TID-7577(p.110–24)
New York Operations Office. Health and Safety Lab., AEC.
THE SHIELDING OF HIGH-ENERGY ACCELERATORS. Leonard R. Solon. p.110–24 of SYMPOSIUM ON TECHNICAL METHODS IN HEALTH PHYSICS, RISÖ, DENMARK, MAY 25–28, 1959. 15p.

Results are summarized from a survey of the problems and approaches to the shielding of high-energy particle accelerators. It is neither likely nor desirable that the expensive experimental work required for optimum accelerator shielding design shall compete with fundamental high-energy research. The principal guideline to the practical shielding of new machines is extrapolation of experience gained with existing accelerators. Fundamental cosmic-ray data and additional high-energy data obtained from existing meson-producing accelerators can furnish reasonable clues to cascade interactions in the targets and shields of contemplated machines. If such data are introduced into Monte-Carlo type calculations, one may hope for reasonably detailed quantitative answers to shielding problems. Advances in the accelerator design art have produced beam energies and currents beyond the original design of most accelerators. Though it is not reasonable to design today's shields to meet all eventualities, a certain amount of flexibility and reserve should be incorporated into the original structure. For example, one might design floor loading to allow an augmented shield, even though the actual shield to be installed is adequate for the immediate future. Synchrocyclotrons have been operating for a decade now in the realm of 200 to 500 Mev. For several years, protons have been accelerated in the Bev region by large synchrotrons. In the not too distant future, we shall accelerate protons to 25 Bev and electrons to something of the order of 50 Bev. And yet, practically all our knowledge of the interactions of radiation with living matter has been obtained from

electromagnetic radiation sources whose energy are below 1.3 Mev, the energy of cobalt-60 gamma radiation, and neutrons below 14 Mev, from the (d, n) reaction in tritium. Perhaps new knowledge and insights are to be gained from applying these large accelerators to experiments on biological systems. Though one does not a priori expect anything fundamentally different, the fact remains that for the shielding of these high radiation sources we are using criteria which have been established for radiations about three order of magnitude less in energy. It appears that the high-energy area deserves some detailed biological attention. (auth)

20057 WT-1464

Naval Radiological Defense Lab., San Francisco.
EVALUATION OF COUNTERMEASURE SYSTEM COMPONENTS AND OPERATIONAL PROCEDURES. W. E. Strope. Aug. 14, 1958. 159p. Project 32.3 of OPERATION PLUMBBOB. $3.00(OTS).

Some operational characteristics of a radiological shelter and values for some countermeasures-system parameters were evaluated. The operation consisted of two phases, the first involving measurements made by project personnel in a manned station having the characteristics of a high-performance radiological shelter and the second involving monitoring and reclamation operations in an area near the shelter beginning about 1 hr after burst. Measurements were made inside the shelter beginning at shot time to test a simple shelter monitoring system; test a proposed ventilation intake configuration intended to eliminate a requirement for filtration of the shelter air supply; determine the effective gamma-radiation shielding afforded by an operational shelter, including two different exhaust ventilation configurations and a simple entrance configuration; and determine those radiation and fall-out characteristics needed to evaluate the operational measurements. The second phase involved the test of a key-point initial monitoring technique; the test of two proposed techniques for determining reclamation effectiveness in advance of reclamation operations; the test of the feasibility of achieving a residual number of 0.01 in a cleared area; and the test of a barrier as an alternative to a buffer zone. Data were obtained on two shots (Diablo and Shasta). The shelter, having a minimum earth-cover thickness of 3 ft, provided an average shielding reduction factor of about 10,000. All openings in the earth cover for ventilation and other purposes were satisfactory from a radiological point of view with the exception of the straight entrance way. The shelter monitoring system provided adequate information. The air-filter data showed no requirement for air filtration at air intake flow rates of 300 to 600 cfm with the intake configuration used. All objectives in the second phase were successfully met with one exception. It was not possible to obtain an adequate test of the feasibility of achieving a residual number of 0.01 in the staging area because of the poor condition of the test area. (auth)

20058 CEA-tr-X-133

INSPECTION GÉNÉRALE POUR LA LUTTE CONTRE L'INCENDIE. (General Inspection for Fire Fighting.) Translated into French from Circular No. 23 of Statens Brandinspektion, Stockholm, Sweden. 46p.

The precautions and procedures to be used by the fire department during disasters at installations where radioactive material is present are presented. The properties of radioactive substances and the dangers inherent in their manipulation are discussed. (J.S.R.)

20059

EQUIPMENT FOR HANDLING MILLICURIE AMOUNTS OF RADIOISOTOPES. W. J. Blaedel and Eugene D. Olsen (Univ. of Wisconsin, Madison). Anal. Chem. 31, 1608(1959) Sept.

A description of laboratory equipment for the handling of millicurie amounts of radioisotopes is given. (C.J.G.)

20060

A METHOD OF DETERMINING THE NATURAL RADIOACTIVITY OF AIR BY PRODUCTS OF RADON FISSION. I. I. Gusarov and V. K. Lyapidevskii (First Moscow "Order of Lenin" Medical Inst. and Moscow Physics and Engineering Inst.). Gigiena i Sanit. 23, No. 10, 10-16(1958) Oct. (In Russian)

A method for the determination of the natural radioactivity of the air by the products of radon fission is described. The various properties of Soviet filters used for the recovery of natural radioactive aerosols are studied. It is recommended that the natural radioactivity of the air be determined by the measurement of the α radiation on the scintillation apparatus of the "B" (P-349-2) installation or the Lyapidevskii diffusion camera. A special formula is proposed for use in hygienic investigations of air radioactivity in order to determine the activity of all short-lived products of radon in the air. (auth)

20061

THE RADIOACTIVITY OF THE ATMOSPHERIC AIR DUE TO AEROSOLS. A. Z. Belousov, Yu. V. Novikov, V. F. Oreshko, and B. I. Polivoda (Moscow Scientific Research Inst. of Sanitation and Hygiene, Ministry of Health, R.S.F.S.R.). Gigiena i Sanit. 23, No. 10, 17-22 (1958) Oct. (In Russian)

The results of systematic investigations of the natural radioactivity of air in the city and in the country are reported. The determination of the amount of α- and β-radioactive aerosols was made by the aspiration method. It was discovered that the radioactivity produced by the aerosols in the city does not differ to any great extent from that in the country: in the city the average β radiation is 2.41×10^{-13} c/l and α radiation is 1.23×10^{-13} and in the country it is 2.54×10^{-13} and 1.6×10^{-13} c/l, respectively. The radioactivity of the air is constantly changing, not only during long periods of time, but even in 24 hrs. The range of fluctuations does not exceed the value of one order. The composition of the aerosols alters considerably and the half life of the radioactive aerosols both for α and β radiations is 34 to 36 minutes. (auth)

20062

EVALUATION OF THE GROUND WATER SOURCES FROM TERRITORIES POLLUTED WITH RADIOACTIVE PRODUCTS FROM URANIUM FISSION. A. S. Belitskii. Gigiena i Sanit. 23, No. 10, 23-7(1958) Oct. (In Russian)

The penetration of radioactive substances from the surface of the ground to the ground water sources does not take place as easily as may be expected. When the protecting layers of the ground are thick and consist of clay and sandy loam, the radioactive substances may never reach the ground waters. In case of direct pollution of ground waters, the radioactive substance travels in the direction of the general flow of water in the water-bearing strata. If the rate of the water flow from the source of the radioactive pollution to some selected point is known, it is possible to determine the extent of the pollution zone. The ground waters are the best protected water sources with respect to pollution with

radioactive substances, provided there are no abandoned drillholes and quarries. (auth)

20063

THE RADIOACTIVITY OF WATER AND BOTTOM DEPOSITS OF CITY PONDS. G. A. Malov, V. F. Oreshko, and M. A. Pinigin (Moscow Scientific Research Inst. of Hygiene and Sanitation, Ministry of Health, R.S.F.S.R). Gigiena i Sanit. 23, No. 10, 28-32(1958) Oct. (In Russian)

The radioactivity of water and of bottom deposits was investigated in 28 ponds in various districts of the city. It was determined that the radioactivity of city ponds is similar to the radioactivity of natural surface waters (lakes). The maximum fluctuations of the radioactivity of water in the ponds do not exceed those of the natural waters. The level of the radioactivity of water and of bottom deposits and the general distribution of radioactivity are affected by the water regime and the sanitary condition of the pond. The smallest amounts of radioactivity were discovered in the ponds which are being cleaned and the water changed regularly. (auth)

20064

THE HYGIENIC CHARACTERISTICS OF NATURAL RADIOACTIVITY OF THE SOIL. V. N. Gus'kova and A. N. Bragina (Inst. of Radiological Hygiene, Ministry of Health, R.S.F.S.R.). Gigiena i Sanit. 23, No. 10, 32-7 (1958) Oct. (In Russian)

The investigation has shown that in cities the β radiations (from K^{40}) were 1020 to 1530 mc/km^2 and in the country, in the majority of cases, 1160 to 1640 mc/km^2. However, there were a few exceptional samples, as for instance, one taken from a granite base emitted β rays of 5,000 mc/km^2. The radioactivity of these samples with respect to γ radiation is expressed by the ratio of $\gamma:\beta$ radiations. In towns this value was 1:5 and in the country 1:4 to 1:8. K^{40} is responsible for 20 to 76% of the radioactivity of the soil. One gram of ashes from the grass emitted from 37 to 784 impulses per gram of ash. Moreover, it was noticed that after burying solid radioactive wastes, the surrounding territory in some instances remained polluted. It is therefore necessary to keep the burial places under strict control and examine occasionally the soil for radioactivity. (auth)

20065

HYGIENIC MEASURES IN HOSPITAL DEPARTMENTS USING RADIOACTIVE ISOTOPES. V. Ya. Golikov (First Moscow "Order of Lenin" Medical Inst.). Gigiena i Sanit. 23, No. 10, 37-41(1958) Oct. (In Russian)

Data obtained during the investigation of the working conditions of personnel of radiological departments at the Institute of Obstetrics and Gynecology of the RSFSR Public Health Ministry are reported. The gynecological treatment procedures, employing compounds of Co^{60} in closed form were studied and it was concluded that the question of personnel protection in radiological departments should be thoroughly investigated with due consideration of every mode of radiation therapy. (auth)

20066

HYGIENIC PROBLEMS IN TRANSPORTATION OF RADIOACTIVE ISOTOPES. R. S. Kalinova. Gigiena i Sanit. 23, No. 10, 41-5(1958) Oct. (In Russian)

The results of investigations of various types of transport containers with respect to the sanitary-hygienic requirements and the data of individual dosimetric examinations of a group of workmen employed in the transportation of radioactive isotopes are reported. Various defects were noted in some types of containers used at present. The data obtained show that it is necessary to improve the system of transportation of radioactive isotopes and to construct containers in accordance with the sanitary-hygienic requirements. (auth)

20067

HYGIENIC PROBLEMS IN THE USE OF IONIZING RADIATIONS IN THE FOOD INDUSTRY. V. A. Arkaev (Central Inst. of Post-Graduate Medical Studies). Gigiena i Sanit. 23, No. 10, 51-8(1958) Oct. (In Russian)

A review is presented of research carried out with ionizing radiation for "cold sterilization" of food products. The sources of radiation, the chemical changes induced, the biological, prophylactic, and hygienic effects of food irradiation, and means for eliminating undesirable effects induced by radiosterilization are discussed. (R.V.J.)

20068

RULES FOR WORKING WITH RADIOACTIVE SUBSTANCES. N. N. Khvostov (Erisman Moscow Scientific–Research Inst. of Sanitary and Hygiene, Ministry of Health, R.S.F.S.R.) Gigiena i Sanit. 23, No. 10, 59-61(1958) Oct. (In Russian)

Rules and regulations are suggested for handling, storage, and transportation of radioactive substances. The rules are specified for various isotopes in relation to their comparative radiotoxicity and practical uses. (R.V.J.)

20069

THE DETERMINATION OF NATURAL RADIOACTIVE AEROSOLS IN THE ATMOSPHERE. A. S. Zykova, V. A. Schastnyĭ, and G. P. Efremova. Gigiena i Sanit. 23, No. 10, 62-4(1958) Oct. (In Russian)

Concentrations of natural radioactive aerosols along the southwestern radius from Moscow were studied at points 125, 100, 90, and 45 km distant. Samples were collected at 1.5 m from the surface for 10 to 20 and 30 to 60 min. The air suction rate in various filters varied from 8 to 14.5 l/min/cm^2. The samples were analyzed 10 to 15 min after they were collected. Some 68 samples were tested. It was found that the mean half life of β and α activity is 35 min. The specific concentrations of β activity varied from 0.5×10^{-13} up to 11×10^{-13} c/l; α activity varied from 0.2×10^{-13} up to 11×10^{-13} c/l. The mean concentrations were $Q_\beta = 3.1 \times 10^{-13}$ c/l, and $Q_\alpha = 4.0 \times 10^{-13}$ c/l. (R.V.J.)

20070

A METHOD OF DETERMINING NATURAL ATMOSPHERIC RADIOACTIVITY DUE TO AEROSOLS. A. Z. Belousov, Yu. V. Novikov, V. F. Oreshko, and B. I. Polivoda (Erisman Moscow Scientific–Research Inst. of Sanitation Hygiene, Ministry of Health, R.S.F.S.R.). Gigiena i Sanit. 23, No. 10, 64-9(1958) Oct. (In Russian)

The aspiration method of selecting specimens was used for simultaneous measurements of β and α active aerosols. Measurements of β activity were made with an end-window counter (T-25 BFL) with 2 mg/cm^2 window; the α activity was measured by scintillation adjustment to the universal radiometer "Tiss." A series of experiments were set up for determining filter efficiency for various volumes of air at constant speed. Filtration of 1800 to 3000 l at 60 l/min for 30 to 50 min reduced the factor of error to 2%. Diagrams are plotted of concentration and decay. The developed method was used for a continuous and systematic recording of the natural background in the atmosphere. The data showed satisfactory results in monitoring short-life aerosols up to 10^{-14} c/l. (R.V.J.)

20071

A METHOD OF DETERMINATION OF RADIOACTIVITY IN THE ATMOSPHERIC DUST. N. M. Tomson. Gigiena i Sanit. 23, No. 10, 69-70(1958) Oct. (In Russian)

Sedimentation and aspiration methods were used for determining radioactivity of atmospheric dust. The long-lived β concentration in the soil which has a long-range effect on humans through vegetation and animals is studied by a sedimentation method using special large containers, drain ditches, and adhesive paper. Settling dust was collected through rain water and snowfall. The aspiration method was used for short-lived α activity. The results of 256 samples collected over half a year showed α activity = 0.5 to 0.7×10^{-13} c/l and β activity = 1.6×10^{-13} c/l. It is suggested that several methods used in parallel produce a more complete picture of the radioactivity in the air. (R.V.J.)

20072

PRELIMINARY DATA ON THE CHARACTERISTICS OF RADIOACTIVITY OF SURFACE WATERS AND POSSIBILITIES OF THEIR POLLUTION WITH SEWAGE. V. M. Kupriyanova and E. S. Romanova (Inst. of Radiation Hygiene, Ministry of Health, R.S.F.S.R.). Gigiena i Sanit. 23, No. 10, 71-2(1958) Oct. (In Russian)

The radioactivity of surface waters was found to be very low; the radioactivity of lake water is somewhat higher than river water. The mean lake water activity (K^{40}) was 1.3×10^{-11} c/l; in rivers 7.7×10^{-12} c/l. The radioactivity of biological organisms and bottom deposits of various reservoirs was found to be within the limits of natural reactivity. The highest radioactivity was found in sewer water of hospitals. The β activity of sewer water from one hospital was as high as 4.4×10^{-9} c/l (K^{40}). (R.V.J.)

20073

DYNAMICS OF ACCUMULATION OF Po^{210} IN THE TISSUES OF FISHES. V. Z. Agranat. Gigiena i Sanit. 23, No. 10, 73-6(1958) Oct. (In Russian)

The concentration of Po^{210} in the tissue of fish depends on the concentration of active substance in the water. The principal uptake takes place during the first day of contact. The maximum is reached after 3 or 4 weeks. The intensity of accumulation can be distributed according to the following: internal organs, gills, scales, bones, and muscle. The maximum concentration is observed first in the gills and scale, somewhat later in internal organs. (R.V.J.)

20074

EXPERIENCE IN THE USE OF A THREE-ZONE PLANNING SCHEME FOR WORK WITH RADIUM. V. P. Granilshchikov, G. M. Parkhomenko. Gigiena i Sanit. 23, No. 10, 76-8(1958) Oct. (In Russian)

Personnel protection data are presented from a laboratory designed for handling radium. The prevention of air contamination in the operational and auxiliary compartments is achieved by effective planning. (R.V.J.)

20075

AN APPLIANCE FOR DISTANCE DEACTIVATION OF POLLUTED SURFACES. N. V. Samokhvalov. Gigiena i Sanit. 23, No. 10, 79-80(1958) Oct. (In Russian)

A simple appliance is described for safe, remote cleaning of contaminated surfaces. (R.V.J.)

20076

THE INVESTIGATION OF THE POLLUTION AND DEACTIVATION OF CLOTHES DURING WORK WITH RADIUM. O. S. Andreeva. Gigiena i Sanit. 23, No. 10, 81-3(1958) Oct. (In Russian)

A systematic dosimetric control of working clothes is recommended for personnel handling radium. Recommendations are made for better methods of storage and more effective means of cleaning and decontamination. (R.V.J.)

20077

INVESTIGATING INHALATION HAZARD USING SYNTHETIC RADIOACTIVE FALLOUT. William B. Lane (Naval Radiological Defense Lab., San Francisco). J. Air Pollution Control Assoc. 9, 102-4(1959) Aug.

Chemical and physical aspects of a program to formulate radioactive aerosols, to design exposure chambers, and to assess the biological hazards by sacrificing exposed animals and analyzing organs and tissues for internally deposited radionuclides are discussed. (C.J.G.)

20078

HOW TO USE PYROPHORIC MATERIALS SAFELY. L. H. Peer and J. T. Reichling (Knolls Atomic Power Lab., Schenectady, N. Y.). Mill & Factory 65, No. 2, 79-83(1959) Aug.

Pyrophoric materials include such things as finely divided zirconium, titanium, hafnium, uranium, and thorium. Safe handling, use, storage, disposal, and fire-fighting techniques for these pyrophoric materials are discussed. Safety hazards in the drilling, grinding, turning, milling, tapping, and shaping of uranium and thorium are presented. (C.J.G.)

20079

CURRENT TRENDS OF STRONTIUM-90, STRONTIUM-89, AND CAESIUM-137 LEVELS IN MILK. W. Anderson, L. K. Burton, and J. O. Crookall (Royal Cancer Hospital, London). Nature 184, 89-91(1959) July 11.

The levels of strontium-90, strontium-89, and cesium-137 occurring in milk produced in west Cardiganshire throughout 1958 are given. A comparison of the mean level of 15.7 s.u. for May-August with the corresponding level of 7.0 s.u. in 1957 shows the increased level in strontium-90. It is noted that in strontium-89 the level is a reflection of weapons testing. The mean November 1958 strontium-89 value (310 $\mu\mu$c/g calcium) is comparable with that found October 1957 (280 $\mu\mu$c/g calcium). The trend of cesium-137 will closely follow that of strontium-90. The cesium-137/strontium-90 ratios throughout the year are similar to values obtained for samples produced prior to the Windscale accident which confirms that cesium-137 is no longer being incorporated in the grass. (C.J.G.)

20080

RADIOLOGICAL HEALTH TRAINING FOR WATER MANAGEMENT PERSONNEL. Presented at Nuclear Engineering and Science Conference, April 6-9, 1959, Public Auditorium, Cleveland, Ohio. Preprint V-7. D. W. Moeller, D. A. Pecsok, and H. P. Kramer (Robert A. Taft Sanitary Engineering Center, Cincinnati). New York, Engineers Joint Council, 1959. 15p. $0.50.

This paper describes the courses for water supply and water pollution control personnel and discusses the growing need for such training. (auth)

20081

SOME CONSIDERATIONS IN THE DEVELOPMENT OF EMERGENCY PROCEDURES IN CASE OF AN ACCIDENTAL RELEASE OF LIQUID RADIOACTIVE WASTES FROM A NUCLEAR REACTOR. Presented at Nuclear Engineering and Science Conference, April 6-9, 1959,

Public Auditorium, Cleveland, Ohio. Preprint V–19. E. D. Harwood (U. S. Public Health Service and U. S. Atomic Energy Commission, Pittsburgh). New York, Engineers Joint Council, 1959. 15p. $0.50.

Basic considerations are presented for development of emergency procedures where the accidental release of radioactive material to a stream is involved. Factors such as conditions of the radioactive release, time of flow to downstream water supply intakes, effects of radioactive decay and dilution, and emergency radiation limits are discussed. (J.R.D.)

20082

ALTERATION OF A GAMMA CELL FOR PLUTONIUM–GAMMA USAGE. Presented at Nuclear Engineering and Science Conference, April 6-9, 1959, Public Auditorium, Cleveland, Ohio. Preprint V–34. H. M. Glen (Oak Ridge National Lab., Tenn.). New York, Engineers Joint Council, 1959. 12p. $0.50.

The structural, mechanical, electrical, remote manipulation, and maintenance alterations necessary to provide containment of airborne alpha-gamma emitters within a remotely operated cell are described and illustrated with particular emphasis on the unique air handling problem encountered. (auth)

20083

CONCEPTS IN DETERMINING THE POTABILITY OF WATER FOLLOWING A NUCLEAR ATTACK. Presented at Nuclear Engineering and Science Conference, April 6-9, 1959, Public Auditorium, Cleveland, Ohio. Preprint V–122. Gerhard Klein (Univ. of California, Berkeley). New York, Engineers Joint Council, 1959. 16p. $0.50.

Reasons for the uncertainty of pre-attack estimates of radiological contamination of water are reviewed. Basic concepts in the formulation of emergency dose criteria for drinking water, based on post-attack radioassays, are developed and avenues of approach to new knowledge in this field are pointed out. (auth)

20084

CONCRETE OR LIKE CONSTRUCTIONAL MATERIALS AFFORDING PROTECTION AGAINST NUCLEAR RADIATIONS. J. H. Fischel and L. Martin. British Patent 805,752. Nuclear Eng. 4, 324(1959) July-Aug.-Sept.

A material suitable for use in the construction of protective buildings is described. A natural or artificial barium compound to afford protection against alpha, beta, and gamma rays and graphite to afford protection against neutrons is used in admixture with a hydraulic binding material. The most convenient and inexpensive barium compound is the natural form known as barytes or heavy spa. The proportion of the barium compound and graphite should be 60 to 86%, and of the cement 40 to 14% (by weight).

INSTRUMENTS

20085 AECD-4290

Sandia Corp., Albuquerque, N. Mex.

RESPONSE OF PRESSURE GAUGES TO DUST-LADEN SHOCK WAVES. J. R. Banister and C. D. Broyles. [nd]. Decl. Feb. 3, 1959. 10p. For [Los Alamos Scientific Lab. Contract W-7405-eng-36]. $1.80(ph), $1.80(mf) OTS.

A series of shock tube studies demonstrates that two types of pressure gages respond to dust carried with shock waves by indicating an increase in dynamic pressure. This contribution to the dynamic pressure is approximately the product of the dust density and the square of the dust velocity under the experimental conditions. Besides this information the studies give insight into the interaction of a square shock wave with dust when that dust is placed in a plane before and parallel to the shock front. It is found that the shape of the pressure wave is little changed except for a rounding of the front. The dust, after accelerating, is carried as a pulse with the mass flow velocity of the air. (auth)

20086 AERE-C/R-2605

United Kingdom Atomic Energy Authority. Research Group. Chemistry Div., Woolwich Outstation, England.

A VERSATILE LIGHT WEIGHT SPECTROGRAPHIC SOURCE UNIT. H. M. Davis and J. Campbell. June 1959. 20p. $0.49(BIS).

A source unit is described which is compact, mobile, and inexpensive. It may be built from readily available components, and the special parts required are simple to make. The source is versatile and can furnish discharges ranging from an energetic spark to an interrupted arc with a repetition rate of 50 or 100 per second. (auth)

20087 AERE-R-2992

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

ON THE DESIGN OF ROTORS FOR NEUTRON VELOCITY SELECTION. N. Umakantha. July 1959. 9p. $0.25(BIS).

A method of approximation is suggested for analyzing the stress distribution in slotted rotors of the kind used in neutron velocity selection. Procedures are given for fixing the parameters of a simple practical design for the Metallurgy Division neutron monochromator. A triple-slot rotor of Mg–Zr alloy, 10 in. in diameter, was made according to these principles and burst on test at a speed of 41,100 revs. min^{-1}, as against a predicted speed of 42,000 revs. min^{-1}. (auth)

20088 AERE-R/M-232

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

A VARIABLE SHEAR-RATE CAPILLARY VISCOMETER FOR USE WITH FLUID METALS. F. A. Johnson. June 1959. 14p. $0.35(BIS).

A simple capillary type viscometer has been designed to investigate the rheological properties of fluid metal slurries. The instrument is capable of being used at various flow rates and at temperatures up to 600°C with conducting fluids of "apparent viscosity" in the range 1 to 10 centipoise. The design of the instrument and work carried out to test and calibrate it with liquid bismuth are described. (auth)

20089 BNL-561

Brookhaven National Lab., Upton, N. Y.

IONIZATION CHAMBERS FOR REACTOR OPERATION. Walter Lones. May 1959. 8p. $0.50(OTS).

The development of boron-coated ionization chambers used in the measurement of neutron, neutron-gamma, and gamma fluxes at the Brookhaven National Laboratory reactors is described. Neutron sensitivities of 6.5×10^{-15} to 3×10^{-14} amp/nv_{th} with corresponding gamma sensitivities of 3.2×10^{-12} to 1.8×10^{-12} amp/r/hr are obtained with polarizing voltages of 110 to 350 volts. (auth)

20090 CERN-59-27
European Organization for Nuclear Research, Geneva.
A PROPOSED FRACTIONAL-NANOSECOND TIME-OF-FLIGHT INSTRUMENT. H. L. Pizer. Aug. 10, 1959. 13p.

A fractional nanosecond time-of-flight instrument is proposed for a particular experiment on the muon gyromagnetic ratio. It will be possible to measure the phase of arrival of the μ meson and electron relative to a fixed frequency (175 Mc/s) and to measure this time difference to a precision of $\frac{1}{6}$ nS in any phase revolution. The instrument in addition is a general purpose time-of-flight device. The range-of-flight times may be arranged to be switched by choosing appropriate frequencies of the fixed generator such that the delay cables between the channels always give a 90° phase shift. (auth)

20091 GAT-232(Del.)
Goodyear Atomic Corp., Portsmouth, Ohio.
THE EFFECT OF FREON-114 ON SPACE RECORDERS. W. E. Hensel, Jr. Apr. 25, 1958. Decl. with deletions July 23, 1959. 14p. Contract AT(33-2)-1. $3.30(ph), $2.40(mf) OTS.

Space recorders are used at Goodyear Atomic Corporation to measure low concentrations of uranium hexafluoride in gas mixtures comprising essentially uranium hexafluoride and nitrogen. The calculations of the amount of uranium hexafluoride are based on the assumption that nitrogen is the only gas mixed with the uranium hexafluoride. The effect of the presence of Freon-114 in such a mixture was investigated in laboratory tests by replacing nitrogen with Freon-114. The tests indicate that Freon-114 produces more ion pairs than nitrogen per molecule, thus increasing the sensitivity of the space recorder. Also, it reduces the background radiation level resulting from residual contamination below that measured in the presence of nitrogen. The sensitivity increased almost linearly with an increase in Freon concentration. The ionization energy per ion pair for Freon-114 was calculated to be 7.0 ± 0.7 electron volts. (auth)

20092 GAT-T-574
Goodyear Atomic Corp., Portsmouth, Ohio.
FACTORS AFFECTING POWER TRANSFORMER FAILURE. A Bibliography. R. D. Hamilton. Sept. 3, 1959. 25p. Contract AT(33-2)-1. $4.80(ph), $2.70(mf) OTS.

After several costly transformer failures a bibliography was compiled with the hope that it would be helpful in seeking a solution to the problems. The bibliography is divided into four main sections: Transformers, Insulation, Moisture, and Oil. Each section is subdivided for easy reference. Failures caused by mechanical defects or by lightning are not covered, since the factors which give rise to such failures are comparatively easy to identify and the steps necessary for correction or prevention are more widely understood. A list of reference materials surveyed and the years covered is included. (auth)

20093 HW-58303
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
PRINCIPLES OF HIGH TEMPERATURE MICROSCOPY. B. B. Brenden, H. W. Newkirk, Jr., and J. L. Bates. June 15, 1959. 40p. Contract W-31-109-Eng-52. $4.80(ph), $2.70(mf) OTS.

An extensive literature survey is presented which deals with the design of microscope objectives suitable for high temperature work, the design of high temperature microscope stages and furnaces, and the problems of high temperature photomicrography. Microscope systems are available having long working distances and with numerical apertures greater than 0.4. These systems have proven suitable for studying microstructure at temperatures above 750 C. Numerical apertures as low as 0.1 are suitable for observation of macrostructures and specimens in image-type furnaces. Several types of excellent furnaces are commercially available. Experimental data are given on the use of cameras with the American Optical Company high temperature microscope. 79 references. (auth)

20094 HW-60338
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
CONVERSION OF MICA-WINDOW G-M TUBE LEAD-PIG COUNTERS TO SCINTILLATION DETECTION. W. G. Spear and G. D. Crouch. May 11, 1959. 8p. $1.80(ph), $1.80(mf) OTS.

Development of a scintillation unit for replacement of the mica-window G-M tubes used in vertical and horizontal lead-pig shelf counters is described. The conversion was considered successful. Factors to be considered when converting other units are listed and discussed. (J.R.D.)

20095 KAPL-M-ACL-1
Knolls Atomic Power Lab., Schenectady, N. Y.
AN EDDY CURRENT CHANNEL SPACING GAGE. A. C. Lind. June 30, 1959. 37p. Contract W-31-109-Eng-52. $6.30(ph), $3.00(mf) OTS.

An eddy current device making use of the "lift off" effect is described for measuring the water channel spacing in plate type nuclear cores. The measuring probe is motor driven to scan the full length of a channel in 10 seconds. Measurements are continuously displayed on a strip chart recording which eliminates the need for point by point measurements to be tabulated by the operator. Actual measurements of channels with the device show a precision of 0.00027 in. for channel spacings between 0.060 in. and 0.080 in. A theoretical analysis of the "lift off" effect using the method of images, which correlates with experimental results, is included. (auth)

20096 RDP-51
Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.
DETECTION OF GASEOUS FISSION PRODUCTS IN WATER—A METHOD OF MONITORING FUEL SHEATHING FAILURES. (Revised Title). P. R. Tunnicliffe and A. C. Whittier. Apr. 16, 1953. Reprinted May 1959. 46p. (AECL-839). $1.50(AECL).

The gaseous activities stripped from samples of effluent coolant from the NRU fuel elements tested in the central thimble of the NRX reactor (NRU loop) and from the NRX main effluent were investigated. The activities obtained from the NRU loop can be attributed to gaseous fission products only. Design data have been obtained for a "Gaseous Fission Product Monitor" to be installed for use with the NRU reactor. It is expected that this monitor will have high sensitivity to activity indicative of an incipient fuel element sheath failure. No qualitative determination of the various gaseous activities obtained from the NRX effluent has been made. A strong component of 25 ± 1 seconds half-life is not consistent with O-19. Limited information concerning sheath failures in NRX was obtained. Of six failures

observed in parallel with the installed delayed neutron monitors, three of these gave pre-warnings and in each case the gaseous fission product monitor showed a substantially greater sensitivity. An experiment in which small samples of uranium, inserted into the NRX reactor, could be exposed at will to a stream of water showed the behavior of the two types of monitors to be similar. However, a number of signals were detected only by the gaseous fission product monitor. These can be attributed to its sensitivity to relatively long lived fission products. (auth)

20097 CEA-tr-A-571
CAMERA VARIABLE DE CONSTRUCTION SIMPLE POUR LA MESURE DE LA DIFFUSION DES RAYONS X AUX TRÉS PETITS ANGLES. (Variable Camera with Simple Construction for the Measurement of X Ray Scattering at Very Small Angles.) H. Fiedler. Translated into French by B. Moreau from Naturwissenschaften 44, 85(1957). 5p.

A "skeleton camera" for the measurement of small-angle x-ray scattering is described. A rectangular prism, having a carefully aligned surface is used for the camera base. Six calibrators are placed on the prism to serve as diaphragm and collimator. A sample plate obtained with this arrangement is given. (J.S.R.)

20098 CEA-tr-R-253
SPECTROMETRE A NEUTRONS. I. INTERRUPTEUR MÉCANIQUE DU FAISCEAU. (Neutron Spectrometry. I. Mechanical Interrupter of the Beam.) V. V. Sokolovskii (Sokolovsky), V. V. Vladimirskii (Vladiminsky), and I. A. Radkevich (Radkevitch). Translated into French by B. de Trezvinsky from Pribory i Tekh. Ekspt., No. 2, 3-9(1956). 19p.

The design and construction of a mechanical neutron chopper are described. With the chopper an almost triangular form of the neutron pulse can be obtained with a base length of 1 μsec. The apparatus can be used for the study of neutrons in an energy zone from thermal to several kev. The efficiency per channel is calculated, and the magnitude of the background is determined. An appendix indicates the method of calculating the form of the neutron pulse. (J.S.R.)

20099 CEA-tr-R-317
SUR LE FIXAGE DES ÉMULSIONS NUCLÉAIRES PAR DES FIXATEURS ACIDES. (The Fixation of Nuclear Emulsions by Acid Fixers.) D. M. Samoilovich and E. S. Barinova. Translated into French from Pribory i Tekh. Ekspt., No. 3, 46-9(1956). 10p.

The solubility of grain of the metallic silver of nuclear emulsions (R-NIKFI) developed in fixer solutions of different pH was studied. It was shown that when the emulsions are fixed in acid fixers the dissolution causes the grain dimensions to decrease. In case of prolonged fixation and with low pH values, a destruction of the particles tracks is observed. The apparent augmentation of the discriminatory power of the emulsions, fixed with acid fixers, is also caused by a decrease of the dimensions of grains already developed and has no direct relationship with the ionizing power of the particles registering the tracks. The fixation of thick emulsions by acid fixers effects a strong decrease of the precision of measurements made with the emulsions. (tr-auth)

20100 CEA-tr-R-621
RÈGLE DOSIMÉTRIQUE POUR LES RAYONNEMENTS MIXTES. (Dosimetric Nomograph for Mixed Radiation.) G. M. Obaturov. Translated into French by B. Vinogradoff from Atomnaya Energiya 4, 585-6(1958). 4p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 16522.

20101 CEA-tr-R-668
AMPLIFICATEUR À CHARACTÉRISTIQUE LOGARITHMIQUE. (Amplifier with Logarithmic Characteristics.) A. N. Sus and V. M. Didenko. Translated into French from Radiotekhnika 10, No. 3, 78-80(1955). 8p.

The design of a five-stage amplifier, operating at 250 kHz, and for which the relationship between the input and output voltages is logarithmic with $U_i = \log U_0$, is presented. The method of graphic calculation of the amplifier is discussed, and the curves calculated for an amplifier with 4.5 to 6 stages are given. (tr-auth)

20102 IGRL-T/CA-113
A NEW MOLECULAR PUMP. W. Becker. Translated by J. Standring (U.K.A.E.A., Risley) from Vakuum-Tech. 7, 149-52(1958). 8p.

The operation and performance of a new molecular pump are described. The new design, resembling that of a turbine, shows an airgap of 1 mm, which is much more than the usual gap of only a few hundredths of a millimeter. The wide airgap ensures extreme reliability in operation. Another advantage of the new design is the high pumping speed which has been achieved by paralleling a large number of suction channels. In spite of the high pumping speed the compression ratio for air is as high as 5×10^7. The ultimate vacuum is practically determined by the leakage of the vacuum system and the outgassing of the walls. The performance of the pump depending on backing pressure and nature of the gas is shown in various diagrams. Finally, the potential applications of the pump are discussed. (auth)

20103 JPRS-tr-L-615-N
EXCERPTS FROM "ELECTRONIC INSTRUMENTS". M. S. Kaufman and G. M. Yankin. Translation of p.117-95 of "Elektronnye Pribory," Moscow, 1957. 81p. $1.75(OTS).

Translations of selected portions of this publication are presented. Included are portions of the book dealing with cavity resonators, klystrons, magnetrons, traveling wave tubes, backward wave tubes, and photoelectric phenomena. An appendix containing diagrams and charts which are related to the described items is included. (J.R.D.)

20104 SCL-T-258
CALCULATION PECULARITIES OF RADIO TRANSMITTERS USED IN CERTAIN METEOROLOGICAL APPARATUS. (Osobennosti Rascheta Radioperedatchikov, Ispol'zusmykh v Nekotorykh Meteorologicheskikh Priborakh.) N. I. Shtein. Translated by Marcel I. Weinreich (Sandia Corp.) from Nauch.-Issledovatel'. Inst. Gidromet. Priborostroen., No. (?), 75-9(1957). 11p. $3.30(ph), $2.40(mf) JCL or LC.

20105
USE OF THE $O^{18}(\alpha,n)Ne^{21}$ REACTION TO MEASURE α-ACTIVITIES OF AQUEOUS SOLUTIONS. V. V. Ivanova, A. I. Nazarov, E. V. Polunskaya, A. G. Khabakhpashev, and E. M. Tsenter. Atomnaya Energ. 7, 166-8(1959) Aug. (In Russian)

The α particle content of aqueous polonium solutions was determined by the yield of neutrons from the $O^{18}(\alpha,n)Ne^{21}$ reaction. An analysis is made of the sensi-

tivity of the reaction, the relation of sensitivity to solution volume, the effects of composition on neutron yield, and the permissible limits of γ background. (R.V.J.)

20106

A NEUTRON DETECTOR HAVING ENERGY-INDEPENDENT SENSITIVITY IN THE RANGE 0.025-14 Mev. P. I. Vatset, S. G. Tonapetyan, and G. A. Dorofeev. Atomnaya Energ. 7, 172-4(1959) Aug. (In Russian)

Descriptions and performance characteristics are given of a modified boron counter for neutron detection. Sensitivity to various energies is plotted. Results show that at certain positions the detector has practically constant sensitivity for 0.025 to 14 Mev neutrons. (R.V.J.)

20107

THE STAL DOUBLE-ROTATION RADIAL FLOW STEAM TURBO-GENERATOR. Ind. Rev. Africa 10, No. 12, 28-9; 31-3; 35-7(1959) June.

The principles of operation, constructional features and the advantages that are claimed for the double-rotation radial flow type over the axial flow type are described, as well as its developments to meet both the requirements of very large outputs and the special needs of nuclear power stations. (auth)

20108

METHOD FOR CALCULATING THE γ-RADIATION AIR DOSAGE IN HOMOGENEOUS GEOLOGICAL MEDIA. R. M. Kogan (Inst. of Applied Geophysics, Academy of Sciences, U.S.S.R.). Izvest. Akad. Nauk S.S.S.R., Ser. Geofiz. No. 7, 988-94(1959) July. (In Russian)

A method is suggested for calculating the γ dose in homogeneous geological media. The air dosage in rocks can be estimated, with an order of accuracy of 5 to 10%, at initial γ quanta energies of 0.3 to 3.0 Mev. (R.V.J.)

20109

MEASUREMENT OF ION SHEATH THICKNESS USING THE DOUBLE PROBE WITH FIXED POTENTIAL. Minoru Sugawara and Yoshisuke Hatta (Tohoku Univ., Sendai). J. Phys. Soc. Japan 14, 1091-3(1959) Aug.

When a negative potential is given to the double probe, usually used as floating condition for gaseous discharge, two ion sheaths formed around the two single probes may overlap. Application is made of this phenomenon in measuring the thickness of ion sheath in a dark plasma. (auth)

20110

ON BUBBLE CHAMBERS. Hilding Slätis (Nobel Inst. of Physics, Stockholm). Nuclear Instr. and Methods 5, 1-25(1959) July.

A short survey is given on the development of the bubble chamber. Glaser's theory is briefly reproduced. Different bubble chambers are described, and photographs of tracks demonstrate the use of these chambers. (auth)

20111

THE ENERGY DEPENDENCE OF THE CORNELL THICK-WALLED IONIZATION CHAMBER. F. J. Loeffler, T. R. Palfrey, and G. W. Tautfest (Purdue Univ., Lafayette, Ind.). Nuclear Instr. and Methods 5, 50-5(1959) July.

The absolute response of a thick-walled ionization chamber of the Cornell design was determined in the energy region 60 to 322 Mev. The determination is the result of intercomparisons with chambers calibrated absolutely at other laboratories, absolute calibration at two energies at this laboratory, and measurements of the relative energy dependence by pair-spectrometer and $Cu^{63}(\gamma,n)Cu^{62}$ activation methods. A plot of the results obtained is given and a comparison with the prediction of shower theory is made. (auth)

20112

PRECISION SCHMITT TRIGGER. Arieh Fischmann-Arbel (Ministry of Defence, Israel). Nuclear Instr. and Methods 5, 56-60(1959) July.

A modified Schmitt Trigger is described which combines the principle of the original circuit with the stability of a cathode coupled difference amplifier. Its hysteresis may be closely controlled by choosing suitable circuit values. Compared with the conventional Schmitt Trigger, this circuit represents an improvement in drift and hysteresis by at least one order of magnitude. (auth)

20113

REVIEW OF FRENCH PROGRESS IN NUCLEAR INSTRUMENTATION. M. Surdin (Centre d'Etudes Nucleaires, Saclay, France). Nucleonics 17, No. 8, 80-2 (1959) Aug.

Progress is included on radiation detectors, heavy-water leak detectors, plutonium monitors, systems for fast coding, and reactor-coolant-system simulators. (C.J.G.)

20114

NEUTRON GAGE MEASURES LIQUID LEVEL IN INTENSE γ-RAY FIELDS. T. W. Mix, D. T. Morgan, P. N. Haubenreich, J. R. Bowen, W. N. Quam, and D. C. Morse (Massachusetts Inst. of Tech., Cambridge). Nucleonics 17, No. 8, 84; 86(1959) Aug.

The design and performance characteristics are given for a fast neutron source and detector system for use in measuring liquid levels in thick-walled stainless steel pipes. The Hornyak button detector is insensitive to intense gamma backgrounds, and the fast neutrons are relatively insensitive to changes from light to heavy water. (D.E.B.)

20115

TRANSISTORIZED AREA MONITOR USES G-M—ION-CHAMBER PROBE. H. A. Brown and J. V. Rogers (Tracerlab, Inc., Richmond, Calif.). Nucleonics 17, No. 8, 88-90(1959) Aug.

Advantages and applications of G-M—ion-chamber probes used in transistorized area monitors are enumerated. Arrangement of this type of monitor system is explained. (C.J.G.)

20116

DETECTION OF FAST NEUTRONS WITH SPARK COUNTERS. Gerhard Krüger (Universität, Giessen, Ger.). Nukleonik 1, 237-41(1959) Aug. (In German)

In order to study the behavior of spark counters with various filling gases with respect to fast neutrons, a series of spark counters was constructed. Two constructions are described. It is shown that there are spark counters with and without steady current. The properties of both these groups were investigated. With a methane-filled 10-filament counter, a response of 0.25% was obtained for fast neutrons from a Po—Be source. The discrimination ratio between neutrons and gamma quanta is therefore $1:5 \times 10^3$. These counters have a marked directional dependence. (tr-auth)

20117

ABSOLUTE CALIBRATION OF COUNTER ARRANGE-

MENTS FOR STRONTIUM-89, YTTRIUM-90, AND BARIUM-LANTHANUM-90 WITH STRONTIUM-YTTRIUM-90 STANDARDS. Günter Herrmann and Karl Habel (Universität, Mainz). Nukleonik 1, 241-5 (1959) Aug. (In German)

A 2π counter and an end window counter were calibrated for the absolute counting of Sr^{89}, Y^{90}, $Ba-La^{140}$, and $Sr-Y^{90}$, and the calibration factors were compared. Correction factors were given through which calibration factors for the short-lived isotopes Sr^{89}, Y^{90}, and $Ba-La^{140}$ could be calculated from the calibration factors determined for the long-lived $Sr-Y^{90}$. (tr-auth)

20118

PHOTOGRAPHIC ACTION OF RADIATION FROM CERTAIN RADIOACTIVE ISOTOPES. N. V. Ushakov. Zavodskaya Lab. 23, 1080-3(1957). (In Russian)

The relationship between the darkening of "XX Roentgen" film and the gamma dose from Ag^{110}, Co^{60}, Ir^{192}, and Ta^{182} was investigated and graphs were plotted. (R.J.V.)

20119

MANOMETER FOR MEASURING THE PRESSURES OF AGGRESSIVE GASES. R. Kh. Burshteĭn and D. L. Kondrashov (Inst. of Electrochemistry, Academy of Sciences, U.S.S.R.). Zhur. Fiz. Khim. 33, 1653-4 (1959). (In Russian)

For measuring the pressures of aggressive gases use was made of a Pirani type manometer in which a copper wire, coated with a glass layer 2 μ thick was hung. The manometer was used to measure the pressure of chlorine in adsorption studies. The calibration curve of the manometer maintained its values in the course of several months. (auth)

20120

SELF-COMPENSATING MEMBRANE MANOMETER. K. V. Chmutov, V. S. Lapik, P. M. Kalachev, and Yu. A. Silkin (Inst. of Physical Chemistry, Academy of Sciences, U.S.S.R.). Zhur. Fiz. Khim. 33, 1655-6(1959). (In Russian)

A simple construction is described for a manometer with a plane glass membrane and provided with an automatic device for compensating the pressure being measured. The design permits measurement of the pressure of aggressive gases over a wide range of values. (auth)

20121

CRITICAL EXPERIMENT SAFETY SYSTEMS WITH ELECTROMETER-TYPE OPERATIONAL AMPLIFIERS. Presented at Nuclear Engineering and Science Conference, April 6-9, 1959, Public Auditorium, Cleveland, Ohio. Preprint V-14. Russell M. Ball (Babcock & Wilcox Co., New York). New York, Engineers Joint Council, 1959. 14p. $0.50.

To meet the need for a high sensitivity multi-channel safety system, fully fedback operational amplifier types were developed and have been in continuous use with three separate critical experiments since November 1956. The input tube is a 5654 operated as a "starved" pentode. Trip levels are set with twin triode difference amplifiers into a common "scram" bus. The bus is connected to other difference amplifiers controlling current either to hydraulic solenoids or to magnetic clutches. Adjustments on this set of difference amplifiers permit sequential dropping for slow approaches to trip levels. Special features of the input are a setback system, which alarm-indicates and can insert control rods when within 10% of scram points, and a guard system which activates the setback whenever tube failure or chamber misfunction occurs. These amplifiers are used as summers, differentiators, and integrators, depending upon the safety application. Component failure and false scrams are minimal. (auth)

20122

ASSEMBLY AND OPERATION OF LOW-LEVEL COUNTING FACILITY. Presented at Nuclear Engineering and Science Conference, April 6-9, 1959, Public Auditorium, Cleveland, Ohio. Preprint V-21. Byron M. Branson, G. R. Hagee, A. S. Goldin, Gerald J. Karches, and Conrad P. Straub (Robert A. Taft Sanitary Engineering Center, Cincinnati). New York, Engineers Joint Council, 1959. 23p. $0.50.

A special facility was constructed and instrumentation assembled for the measurement of low levels of beta and gamma emitting radionuclides in environmental samples. The problems encountered on site selection, construction, assembly, and operation are discussed. Instruments selected include a low background (anticoincidence) beta counter, a low-level gamma spectrometer, and a liquid scintillation spectrometer. An evaluation of the performance and a description of applications of these instruments are given. (auth)

20123

DESIGN AND DEVELOPMENT OF A 600°F PULSE PREAMPLIFIER FOR NUCLEAR INSTRUMENTATION. Presented at Nuclear Engineering and Science Conference, April 6-9, 1959, Public Auditorium, Cleveland, Ohio. Preprint V-23. W. L. Frisby and E. M. Palmer (General Electric Co., Burlington, Vt.). New York, Engineers Joint Council, 1959. 27p. $0.50.

Design and evaluation of a high-temperature pulse preamplifier capable of amplifying low-level fission chamber pulses near the source are described. The preamplifier is designed to withstand equipment temperatures of 542°F and radiation environment equivalent to 10^9 rep's of 1-Mev gamma photons and 10^8 rep's of 1-Mev neutrons. (J.R.D.)

20124

CIRCUITS IN THE MTR PULSE ANALYZERS. Presented at Nuclear Engineering and Science Conference, April 6-9, 1959, Public Auditorium, Cleveland, Ohio. Preprint V-26. Frank Petree (Phillips Petroleum Co., Idaho Falls, Idaho). New York, Engineers Joint Council, 1959. 42p. $0.50.

Circuits developed for use in MTR pulse analyzers include a randomly pulsed crystal controlled time-base generator, plug-in printed-circuit transistor modules, a magnetic core temporary storage circuit which reduces dead time to 2.3 microseconds per pulse, and a magnetic memory core drive circuit using 48 drive transistors to address 1024 channels. (auth)

20125

HALOGEN TUBE REMOTE AREA MONITORING SYSTEM. Presented at Nuclear Engineering and Science Conference, April 6-9, 1959, Public Auditorium, Cleveland, Ohio. Preprint V-27. H. A. Brown, J. V. Rogers (Tracerlab, Inc., Richmond, Calif.). New York, Engineers Joint Council, 1959. 11p. $0.50.

After analyzing radiation monitoring requirements and studying various systems, Tracerlab has evolved a new area monitor which offers the advantages of no zero drift, five-decade range, and only two monthly calibration adjustments. A small halogen-quenched G-M detector is used in a unique circuit that will cover the range,

background to 50 r/hr. At radiation levels below 1/10 r/hr the detector operates as a normal pulse G-M detector while at high intensities it acts as an ion chamber. The circuitry utilizes transistors in the probe, and produces a logarithmic response. The alarm features permit reading radiation level from any channel even after exceeding the alarm level. Remote meters for calibration purposes or remote indication can be plugged directly into the sealed probes. (auth)

20126

EFFECTS OF REACTOR EXPOSURE ON BORON-LINED BF_3 PROPORTIONAL COUNTERS. Presented at Nuclear Engineering and Science Conference, April 6-9, 1959, Public Auditorium, Cleveland, Ohio. Preprint V-58. William N. Trenholme (General Electric Co., West Lynn, Mass.). New York, Engineers Joint Council, 1959. 23p. $0.50.

The results of reactor exposure on the characteristics of several types of boron-lined and BF_3-filled proportional counters are presented, and the important design and application criteria that lead to improved performance of counters after long reactor exposure are discussed. (auth)

20127

A DIFFERENTIAL PRESSURE INSTRUMENT FOR HIGH TEMPERATURE SERVICE. Presented at Nuclear Engineering and Science Conference, April 6-9, 1959, Public Auditorium, Cleveland, Ohio. Preprint V-60. Stephen A. Hluchan (Taylor Instrument Companies, Rochester, N. Y.). New York, Engineers Joint Council, 1959. 25p. $0.50.

An instrument for measuring flow and liquid level of process fluids at temperatures to 1500°F and pressures to 500 psig (both conditions not imposed simultaneously) has been developed. It consists of a differential pressure transmitter connected by means of two long capillary lines to high and low pressure diaphragm seal units contacting fluid filling with NaK. An unbonded strain gage force transducer in the transmitter provides a dc electrical output. (auth)

20128

CLAMP-ON RESISTANCE TEMPERATURE DETECTORS FOR REACTOR USE. Presented at Nuclear Engineering and Science Conference, April 6-9, 1959, Public Auditorium, Cleveland, Ohio. Preprint V-61. R. G. Clark (General Electric Co., Richland, Wash.). New York, Engineers Joint Council, 1959. 9p. $0.50.

Results are given of tests on a removable clamp-on resistance temperature detector, designed for monitoring the coolant of a reactor by monitoring surface temperature of the pipe. These included the response after extended thermal cycling, the performance after exposure to radiation, and measurements of insulation resistance, response times, and accuracy. (auth)

20129

TRANSIENTS IN LOGARITHMIC COUNT-RATE AND PERIOD METERS. Presented at Nuclear Engineering and Science Conference, April 6-9, 1959, Public Auditorium, Cleveland, Ohio. Preprint V-125. Bruce Barrow (Shape Air Defense Technical Center, The Hague) and Robert Maitland (General Electric Co., Cincinnati). New York, Engineers Joint Council, 1959. 19p. $0.50.

Several classes of differentiating networks are analyzed in connection with the general problem of differentiating a signal while filtering out undesired wide-band noise. An indication of the relative quality of performance of these various networks is given, and confirmed quantitatively for the log-diode period meter. Experimental measurements of transient performance are reported, and these confirm the predictions from theory. The experiments involved both a simple log-diode circuit and an entire period meter. Transient inputs were obtained from an exponential-current generator and, later, from a reactor simulator operated with various reactivity inputs. (auth)

20130

A HIGH SPEED MICROCURRENT AMPLIFIER. Presented at Nuclear Engineering and Science Conference, April 6-9, Public Auditorium, Cleveland, Ohio. Preprint V-126. John A. Dever and Louis Sickles (Minneapolis-Honeywell Regulator Co., Philadelphia). New York, Engineers Joint Council, 1959. 15p. $0.50.

By the use of feedback amplifier techniques, considerable improvement has been made in the speed and/or stability of the familiar electrometer tube micro-microammeter. Simplicity and compactness have been retained. With 100 feet of input cable, the amplifier has a 150 millisecond time constant at 10^{-11} amperes full scale with 0.05%/day stability. (auth)

20131

PRINCIPLES AND APPLICATIONS OF PROPORTIONAL COUNTERS FOR X-RAY SPECTROGRAPHS. Irwin I. Bessen (Philips Electronics, Inc., Mount Vernon, N. Y.). p.455-69 of "Proceedings of the Sixth Annual Conference on Industrial Applications of X-Ray Analysis, August 7-9, 1957, Denver, Colorado." William M. Mueller, ed. Denver, University of Denver, [1958]. 502p.

The two general uses of proportional counters in x-ray analysis are discussed in the light of advantages and limitations inherent in the type of counter construction. Some effects on spectrographic results and industrial gaging are cited. (auth)

20132

EFFECTS OF RADIATION ON TV CAMERA COMPONENTS. Nuclear Power 4, No. 40, 93-4(1959) Aug.

Examples of radiation damage in electronic components for TV cameras designed for use inside a reactor core are given. Rules for the designer of the component parts to follow are listed. (C.J.G.)

20133

ELECTROMAGNETIC PUMPS. P. Fortescue (to UK Atomic Energy Authority). British Patent 804,621. Nuclear Eng. 4, 324(1959) July-Aug.-Sept.

A liquid metal duct is arranged axially within the poles of a three-pole circular iron yoke structure. A magnetic field is created transversely across parts of the duct section in turn by field coils on the yoke (with secondary windings and electrodes around the duct) excited by three-phase current and thus a longitudinal pumping action is effected on the liquid metal in the duct.

ISOTOPES-INDUSTRIAL TECHNOLOGY

20134 CEA-tr-R-613

UTILISATION DES ISOTOPES RADIOACTIFS DANS L'INDUSTRIE DU BÂTIMENT. (Utilization of Radioactive Isotopes in the Building Industry.) A. A. Dobrin-

skaya. Translated into French by [B.] Vinogradoff from Uspekhi Fiz. Nauk 60, 327-59(1956). 45p.

A general survey is presented on the more important works on the utilization of radioisotopes for the study of construction materials and equipment, control of metallic construction and heating and ventilation installations, and the resolution of problems of the construction industry. 74 references. (J.S.R.)

METALLURGY AND CERAMICS

20135 AECU-4333

Aeroprojects, Inc., West Chester, Penna.

ULTRASONIC POWER REQUIREMENTS FOR PROCESSING LMFR BLANKET TO PRODUCE EQUIAXED THORIUM BISMUTHIDE PARTICLES. Research Report No. 59-14. W. B. Tarpley, C. D. McKinney, Jr., and J. G. Thomas. Apr. 1959. 47p. [For Brookhaven National Lab.]. Contract AT-30-2-GEN-16, Subcontract S-370. $7.80(ph), $3.30(mf) OTS.

During processing of the proposed breeder blanket for the LMFR, which consists of a slurry of $ThBi_2$ in molten bismuth, handling difficulties are encountered if the intermetallic particles normally crystallize as platelets of up to 1 cm diameter. Since earlier experiments had established the feasibility of producing small particle sizes by ultrasonic application during cooling from solution temperature, further study was made to determine ultrasonic power requirements for treatment of the breeder blanket and to select a suitable coupler material for transmitting ultrasonic energy into the melt. On the basis of 2.4 kg (5 lb) batch treatment, the ultrasonic energy required for producing generally equiaxed particles of less than 100μ diameter was estimated to be 25 kwhr per ton of liquid metal treated. Extrapolation of these data to 24-hr continuous treatment of the breeder blanket indicates the requirement for an installation delivering 40 kw of ultrasonic power. Preliminary investigation of brief ultrasonic treatment followed by mild mechanical agitation, such as might be provided by pump circulation, suggests that equiaxed particles can be produced with an energy input of 5-10 kwhr per ton and an ultrasonic installation delivering 8 to 17 kw. Examination of various candidate construction materials for the ultrasonic treatment apparatus showed molybdenum to be essentially resistant to corrosion and erosion under the treatment conditions. (auth)

20136 ANL-5372

Argonne National Lab., Lemont, Ill.

RECORDING QUARTZ DIFFERENTIAL DILATOMETER. L. T. Lloyd. July 1959. 49p. Contract W-31-109-eng-38. $1.50(OTS).

The design of a recording quartz differential dilatometer is described. The instrument embodies desirable features of automatic operation with a flexible heating and cooling program control plus continuous recording of expansion data, as well as other features unique to the problem of dilatation measurement at hand. Sensitivity, precision and accuracy of the instrument are discussed in relation to data obtained with standard specimens. Operational procedures and typical experimental curves are included. (auth)

20137 ANL-5972

Argonne National Lab., Lemont, Ill.

THERMAL EXPANSION OF ALPHA-URANIUM SINGLE CRYSTALS. L. T. Lloyd. June 1959. 48p. Contract W-31-109-eng-38. $1.50(OTS).

Dilatometric measurements were obtained between 25 and 650°C from alpha-uranium single crystals in the three principal crystallographic directions. Least mean square fitted equations representing these directions and volume as functions of temperature (t°C) are as follows:

$$L_{[1\,0\,0]_t} = L_{[1\,0\,0]_{0°C}} (1 + 23.53 \times 10^{-6}t + 13.74 \times 10^{-9}t^2 + 9.94 \times 10^{-12}t^3)$$

$$L_{[0\,1\,0]_t} = L_{[0\,1\,0]_{0°C}} (1 + 1.16 \times 10^{-6}t - 9.43 \times 10^{-9}t^2 - 11.79 \times 10^{-12}t^3)$$

$$L_{[0\,0\,1]_t} = L_{[0\,0\,1]_{0°C}} (1 + 19.38 \times 10^{-6}t + 21.58 \times 10^{-9}t^2 + 3.32 \times 10^{-12}t^3)$$

$$V_t = V_{0°C} (1 + 43.98 \times 10^{-6}t + 26.88 \times 10^{-9}t^2 + 1.00 \times 10^{-12}t^3)$$

Comparisons of fraction expansions of single crystals with those derived from lattice parameter measurements indicate that portions of the latter data are subject to errors because of elastic interactions between grains of polycrystalline samples. (auth)

20138 ANL-5973

Argonne National Lab., Lemont, Ill.

TESTING OF POTENTIAL BEARING MATERIALS IN AN ARGON ATMOSPHERE OF LOW HUMIDITY. N. J. Carson, Jr. and W. H. Morris. Aug. 1959. 27p. Contract W-31-109-eng-38. $0.75(OTS).

Bearing materials for use in the Metallurgy Division Sector of the EBR-II Fuel Cycle Plant must operate without lubrication in an argon atmosphere of low humidity (dew-point of −50°C or less) and high gamma activity. To select suitable materials, a test program, in which samples of materials known to be radiation resistant were tested for wear resistance in an argon atmosphere containing less than 30 ppm water by volume, was initiated. The criterion by which wear resistance was judged is loss in sample weight over a 24-hour abrasion period during which the samples rub along the periphery of a $2\frac{1}{2}$-in. OD wear ring made of SAE 1045 steel. The majority of the samples were tested using a load of 2755 gm and a rubbing velocity of 109 ft per sec. Contact between the rectangular samples and the wear ring was initially linear. Of the materials tested, Reactor Grade Graphite and some graphite derivatives showed the best bearing qualities. A group of steel samples coated with impregnated plastic also showed desirable properties. While they are not as wear resistant as the best graphitic samples, their superior physical properties give them a wider range of application. (auth)

20139 ANL-6001

Argonne National Lab., Lemont, Ill.

RECRYSTALLIZATION OF DEFORMED ALPHA-URANIUM SINGLE CRYSTALS. Final Report—Metallurgy Division Program 4.1.19. Work Completed—January 1, 1956. L. T. Lloyd. July 1959. 58p. Contract W-31-109-eng-38. $1.75(OTS).

The orientation relationships between deformed alpha-uranium single crystals and recrystallized grains grown in them by annealing can be expressed as 27.5° rotations about axes located 70.0° from the [100], 63.5° from the [010] and 34.0° from the [001] of the deformed orientation. The rotations are clockwise about two of the axes and counterclockwise about the

other two. In deriving these relationships it was necessary to consider the recrystallized grains as originating from deformation twin orientations as well as from the parent crystal orientation. The relationship agrees well with experimental observations of recrystallization textures developed from deformation textures for polycrystalline rod and sheet uranium treated in the alpha phase. (auth)

20140 ANL-6007
Argonne National Lab., Lemont, Ill.
CASTING OF A URANIUM SHIELD FOR A KILOCURIE COBALT-60 SOURCE. R. J. Dunworth and R. E. Macherey. Aug. 1959. 12p. Contract W-31-109-eng-38. $0.50(OTS).

Casting a U shield for a kilocurie Co^{60} source is described. The melting equipment is described, and data on the castings are tabulated. Examination of the casting revealed no large blow holes or cracks, and the method was considered adequate. (J.R.D.)

20141 APEX-516
Illinois Inst. of Tech., Chicago. Armour Research Foundation.
THERMAL CONDUCTIVITY OF SILICON CARBIDE POWDER. Sept. 1959. 7p. ARF Project D-174. For General Electric Co. Aircraft Nuclear Propulsion Dept. Contracts AF33(600)-38062 and AT(11-1)-171, Subcontract AT-91-9. $0.50(OTS).

The thermal conductivity of silicon carbide packed to a density of 99 lb/ft^3 was measured as a function of temperature from 100 to 1900°F in air and in helium. Details of apparatus and methods of measurement are described and the results of the measurements presented. (auth)

20142 BM-RI-5499
Bureau of Mines.
ZIRCONIUM–HAFNIUM SEPARATION. William A. Stickney. Mar. 1959. 24p.

During 33 months of operation the purification plant at Albany, Oreg., processed 2,500,000 pounds of commercial zirconium tetrachloride to produce low-hafnium zirconium oxide and low-zirconium hafnium oxide. The average hafnium content of the zirconium oxide was about 40 ppm and the hafnium oxide contained less than 2% zirconium. The separate oxides were converted to sponge metal by the Kroll process in another section of the plant. Although corrosion was a major problem, modifications of equipment by adoption of resistant materials and continuous washing down and maintenance of equipment and plant served to reduce materially the corrosive action of the chemicals and fumes. An accurate equilibrium-data diagram to establish variables for separation of zirconium and hafnium in the aqueous and organic phases was never satisfactorily established. The data accumulated showed considerable scatter, and no definite trends were demonstrated nor was correlation obtained for any exponential power of flow ratio to metal transfer. Of interest, however, was the fact that the greatest possible transfer of metal took place in the first and fourth columns of the extraction system. These were the points in the system where fresh feed first contacted the organic stream and where metal-free solvent first contacted the aqueous stream. Conditions within the second and third columns remained relatively stable. (auth)

20143 BMI-904
Battelle Memorial Inst., Columbus, Ohio.
THE FABRICATION OF STAINLESS STEEL–URANIUM DIOXIDE FUEL ELEMENTS. J. R. Keeler, D. L. Keller, and L. J. Cuddy. Mar. 2, 1954. Decl. Aug. 10, 1959. 28p. Contract W-7405-eng-92. $4.80(ph), $2.70(mf) OTS.

Stainless steel-clad fuel sheet 0.020 in. thick with a 0.008-in. core of stainless steel plus UO_2 was produced by roll cladding a powder-metal compact. The effects of processing variables, core-matrix composition, quantity of oxide, and oxide particle size on the properties of the sheet were investigated. The strength and ductility of the core decreased sharply as the quantity of oxide in the core increased from 20 to 40 wt.%. Over the range of matrix compositions investigated, the particle size of the oxide had little effect on the core strength. In cores containing 25 wt.% of oxide, an 18 wt.% chromium–82 wt.% iron matrix prepared from the elemental metal powders had the highest strength and ductility, but this matrix was susceptible to cracking during thermal cycling. An elemental 18 wt.% chromium–9 wt.% nickel–73 wt.% iron matrix was the most satisfactory from the standpoint of fabrication and over-all characteristics of the resulting sheet. (auth)

20144 BMI-912(Del.)
Battelle Memorial Inst., Columbus, Ohio.
ELECTROPLATED METALS ON URANIUM. J. G. Beach, W. C. Schickner, C. R. Konecny, and C. L. Faust. May 7, 1954. Decl. with deletions June 18, 1959. 33p. $6.30(ph), $3.00(mf) OTS.

Electroplating on uranium is being studied in connection with the development of an improved, slug-type fuel element for the Hanford Reactors and an aluminum-clad, flat-plate fuel element for the Savannah River Reactors. These electroplating studies and concurrent metallurgical cladding studies are integrated to expedite development of an aluminum-uranium-diffusion barrier, and a bonding medium between the uranium and the aluminum cladding. Electrodeposited aluminum, chromium, copper, iron, manganese, nickel, palladium, tin, and zinc on uranium were investigated. Four factors were found to influence the corrosion protection of uranium by electroplated metals: uranium surface preparation, method of electrodeposition, type and thickness of electroplated metal, and conditions of heat treating required to surface alloy the composite. Vacuum heat treatment of uranium plated with nickel or iron forms an alloy coating. The alloy-coated uranium resists corrosion in boiling water for periods from 100 to 1000 times that of bare uranium. Hot-water attack of this alloy-coated uranium is generally localized as pit-type corrosion at areas of defects originating in the uranium metal. Thin as-deposited metals on uranium offer little or no corrosion resistance. Heat treatment of aluminum, chromium, copper, manganese, tin, or zinc-plated uranium did not provide corrosion resistance. (auth)

20145 BMI-1373
Battelle Memorial Inst., Columbus, Ohio.
THE DIFFUSION OF HYDROGEN IN BETA ZIRCONIUM. William M. Albrecht and W. Douglas Goode, Jr. Aug. 25, 1959. 13p. Contract W-7405-eng-92. $0.50 (OTS).

Diffusion coefficients for hydrogen in beta zirconium were determined from permeation rates in the range 650 to 850°C. Both the steady-state method, which is dependent upon the hydrogen concentration, and the time-lag method, which is independent of hydrogen concentration, were employed to obtain diffusion data. Zirconium disks, 0.03 to 0.1 cm thick and varying in hydrogen concentration from 9 to 33 at. %, were used to

measure permeation rates. The diffusion coefficients determined by the steady-state and time-lag methods on samples of differing thickness were in agreement. It was concluded that the permeation process was diffusion controlled. The diffusion coefficients were found to be independent of concentration and can be expressed by $D = 6.14 \times 10^4 \exp(-45{,}900/RT)$. (auth)

20146 BNL-4356
Brookhaven National Lab., Upton, N. Y.
A QUANTITATIVE METHOD FOR DETERMINING THE EFFECTS OF ALLOYING CONSTITUENTS ON THE FILM FORMATION PROPERTIES OF DIFFERENT STEELS. Metallurgy Memo No. 741. D. G. Schweitzer. Feb. 26, 1958. 12p. $3.30(ph), $2.40(mf) OTS.

Experimental evidence obtained from high temperature, 650 to 820°C short time, static corrosion tests shows that the corrosion resistance of steels to bismuth is in part due to the formation of insoluble films of ZrN, ZrC, or combinations of the two on the steel surfaces. These films are formed by reaction of zirconium dissolved in the bismuth with the nitrogen and carbon in the steel. The best possible solution to the corrosion problem as far as film formation is involved will be obtained by determining which steel produces the best "performing" film. Such a steel and the film associated with it must satisfy the following conditions: The rate of film formation must be greater than the rate of corrosion of the steel so that the film can deposit before the surface is attacked and removed from the matrix; the film must be continuous so that the matrix is not attacked locally; the steel must contain a reservoir of "available" nitrogen or carbon so that film rehealing is possible in the event of loss due to flaking, thermal stress, etc.; the rate of depletion of this reservoir (whether it be due to continuous film formation or some side reaction within the steel) must be slow enough so that the steel can be used for times long enough to be practical; and the steel must have desirable physical properties. (auth)

20147 CF-58-2-15
Oak Ridge National Lab., Tenn.
METALLOGRAPHIC EXAMINATION OF L6Z-114 IN-PILE AUTOCLAVE PINS. A. E. Richt. Feb. 5, 1958. 10p. Contract [W-7405-eng-26]. $1.80(ph), $1.80(mf) OTS.

During the examination of the pins from in-pile autoclave L6Z-114 it was noted that each of the double-notched pins exhibited areas of increased corrosion while the exact duplicate single-notched pins did not. The two pairs of Zircaloy-2 pins were identical in structure and thus the noted difference in corrosive attack cannot be attributed to this factor. In the Zr–1.5% Sn–15% Nb pins the corrosive attack did not seem dependent on the slight variation in structure of the pins. (W.L.H.)

20148 CF-59-6-55
Oak Ridge National Lab., Tenn.
APPLICATION OF ELECTROLESS-NICKEL BRAZING TO TUBULAR FUEL ELEMENTS FOR THE N. S. SAVANNAH. Status Report. J. T. Lamartine and W. C. Thurber. June 2, 1959. 31p. Contract [W-7405-eng-26]. $6.30(ph), $3.00(mf) OTS.

The feasibility of using electroless nickel, a chemical deposit containing about 10 wt. % phosphorous in nickel, as the brazing alloy for assembling tubular stainless steel fuel elements of the type specified in Core I of the N. S. Savannah was investigated. This material was selected primarily because of the ease of braze-metal preplacement by chemical deposition of the alloy on type 304 stainless steel ferrule spacers, prior to fuel-bundle assembly. Brazed joints produced by this method were generally characterized by a relatively ductile solid-solution region at the thinnest portions of the fillet. This ductile zone should minimize the possibility of complete propagation of hairline cracks, which form in the brittle, eutectic regions of fillet. The microstructural appearance of the electroless-nickel joints was not appreciably affected by variations in the brazing temperature from 1750 to 1900°F or the brazing time from 15 to 60 min. Several plating solutions were evaluated and all were found to be capable of producing deposits suitable for brazing applications. Corrosion tests conducted in static 525°F water indicated that no significant attack of joints brazed with electroless nickel had occurred after 300-hr exposure. A small fuel bundle was successfully assembled by brazing with electroless nickel. (auth)

20149 DMIC-Memo-27
Battelle Memorial Inst. Defense Metals Information Center, Columbus, Ohio.
ARC WELDING OF HIGH-STRENGTH STEELS FOR AIRCRAFT AND MISSILE STRUCTURES. J. T. Niemann, R. P. Sopher, and P. J. Rieppel. July 31, 1959. 44p.

Data on arc welding hot-work die steels, precipitation-hardening stainless steels, and martensitic stainless steel are presented. It is pointed out the search for information is continuing. (J.R.D.)

20150 DMIC-Memo-30
Battelle Memorial Inst. Defense Metals Information Center, Columbus, Ohio.
MILLING OF HIGH-STRENGTH STEELS IN THE HARDNESS RANGE OF 330 TO 560 BRINELL. C. T. Olofson. Aug. 17, 1959. 39p.

Information and data on face milling, end milling, side milling, and slotting of steels at hardness levels up to 560 Brinell are reported. The machining problems of low tool life and low production rate for these steels are minimized if rigidity of machine, tool, and workpiece and adequate power to maintain cutting speed exist throughout cutting. The proper selection of feeds, speeds, and depths of cut appropriate to recommended tool materials and designs are equally important. (auth)

20151 DMIC-Memo-32
Battelle Memorial Inst. Defense Metals Information Center, Columbus, Ohio.
PHYSICAL AND MECHANICAL PROPERTIES OF TANTALUM. H. R. Ogden. Aug. 28, 1959. 18p.

Selected physical and mechanical properties of tantalum at room and elevated temperatures are presented in tabular form. (J.E.D.)

20152 DP-96
Du Pont de Nemours (E. I.) & Co. Engineering Research Lab., Wilmington, Del.
CORROSION IN HYDROGEN SULFIDE–WATER SYSTEMS. J. A. Snyder and D. Warren. Oct. 1955. Decl. Mar. 7, 1957. 240p. Contract AT(07-2)-1. $37.80(ph), $11.10(mf) OTS.

A detailed report is presented of the corrosion test work on the behavior of materials of construction in the H_2S–H_2O system. (auth)

20153 HW-55319
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
URANIUM DIOXIDE–PLUTONIUM DIOXIDE CERAMICS. A. S. Wilson. Mar. 1, 1958. 10p. $3.30(ph), $2.40(mf) OTS.

The results of experiments performed with UO_2-PuO_2 fuels are reported. The coprecipitation of ammonium diuranate and plutonium hydroxide and their reduction to the oxides has been successful in preparing a solid solution of UO_2-PuO_2. A free flowing powder mixture of $MgO-PuO_2$ was prepared by precipitation of the oxalates in a neutral to ammonical solution and by subsequent decomposition to the oxides at 700°L. A free flowing uniform powder mixture of $MgO-UO_2$, substituting for PuO_2, was prepared with a twin shell dry blinder. (W.L.H.)

20154 KAPL-2048
Knolls Atomic Power Lab., Schenectady, N. Y.
BIBLIOGRAPHY ON THERMAL STRESSES AND LOW-CYCLE FATIGUE. D. R. Miller. Aug. 20, 1959. 33p. Contract W-31-109-Eng-52. $1.50(OTS).

This bibliography consists principally of references to domestic publications on subjects that pertain to thermal stresses and low-cycle fatigue in nuclear reactors and power apparatus. Both major subjects are included in the same bibliography, because cyclic thermal stresses or thermal differential strains are frequently sufficiently high to cause fatigue cracking in on the order of 100,000 cycles or less. The problem of fatigue cracking in this range of cycles-to-failure is considered low-cycle fatigue. The references are placed, according to the character of the principal content, in the following groupings: Material Test Data, Service Experience and Component Tests, Stress Analysis, Design, and Miscellaneous. (auth)

20155 KAPL-M-ACC-3
Knolls Atomic Power Lab., Schenectady, N. Y.
EXAMINATION OF WELDS IN HAFNIUM "WYE" CONTROL RODS. Allen C. Cooley and William E. Ray. Aug. 4, 1959. 17p. Contract W-31-109-Eng-52. $3.30(ph), $2.40(mf) OTS.

Transverse sections from the welded areas of two hafnium "wye" control rods were examined. Effects from the welding procedure were measured and photomicrographed. The results of this study indicate that the presence of an axial void and residual blade joint traces will not detract appreciably from the mechanical performance of this type of control rod. (auth)

20156 KAPL-M-JDL-1
Knolls Atomic Power Lab., Schenectady, N. Y.
THE CREEP BEHAVIOR OF ZIRCALOY-2. J. D. Lubahn. June 12, 1959. 12p. Contract W-31-109-Eng-52. $3.30(ph), $2.40(mf) OTS.

The creep behavior of Zircaloy-2 at temperatures from 800 to 1200°F was expressed in equation form. These equations take account of recovery and strain hardening and otherwise conform to known behavior characteristics. Consequently they may be applied to stresses and temperatures somewhat outside the range of the data. They were developed for use in machine calculation of the swelling of dispersion fuels relating temperature, fission gas, pressure, and relaxation of its matrix alloy. (auth)

20157 KAPL-M-LD-3
Knolls Atomic Power Lab., Schenectady, N. Y.
NUMERICAL STRESS ANALYSIS FOR THIN CONICAL SHELLS WITH NON-UNIFORM WALL THICKNESS SUBJECTED TO AXISYMMETRIC LOADS. L. Deagle. July 21, 1959. 35p. Contract W-31-109-Eng-52. $6.30(ph), $3.00(mf) OTS.

The deflection, slope, and stresses (in the hoop and axial directions on both surfaces) are obtained, by a numerical method, for a shell of revolution having a linearly varying wall thickness and a linearly varying radius subjected to uniform pressure, an arbitrary axial temperature gradient, and arbitrary edge loads or motions. Examples comparing the numerical solution with analytical or experimental results are given. (auth)

20158 KAPL-M-RA-3
Knolls Atomic Power Lab., Schenectady, N. Y.
MEASUREMENT OF PHASE DISTRIBUTIONS BY INTERCEPT FRACTIONS. R. J. Allio and P. A. Oldow. June 22, 1959. 29p. Contract W-31-109-Eng-52. $6.30(ph), $3.00(mf) OTS.

Equipment has been developed for measuring the characteristics of multiphase dispersions of solids. The spatial and size distribution may be expressed in terms of a phase intercept fraction, defined as the proportion of a scan line occupied by a given phase. Data are presented for dispersions of B_4C particles in a Zircaloy-2 matrix. Data may be used to compute volume percent, homogeneity, preferential orientation of phases, and mean particle size. Results may also be applied to the calculation of nuclear microscopic self-shielding. (auth)

20159 KAPL-M-REC-1
Knolls Atomic Power Lab., Schenectady, N. Y.
THE CORROSION BEHAVIOR OF 3.5 w/o NATURAL URANIUM-ZIRCONIUM BASE FUEL ALLOY. E. G. Brush, R. E. Campagnoni, and M. A. Powers. June 16, 1959. 42p. Contract W-31-109-Eng-52. $7.80(ph), $3.30(mf) OTS.

Tests were conducted to determine the corrosion behavior of 3.5 weight per cent (natural) uranium–zirconium base fuel alloy as a function of heat treatment and test water medium. Ten heat treatments and three water media were involved. A comparison of method of surface treatment was also evaluated. The results indicate that there were no significant differences in the corrosion behavior of the alloy among the three water treatments. They also indicate that the effect of surface treatment upon weight change was insignificant, except in the case of one heat treatment. The heat treatments may be classified in order of decreasing corrosion resistance as follows: (1) rapidly quenched; (2) slowly cooled from 800°C; (3) furnace cooled from 950°C; and (4) air cooled from 950°C. From the 950°C heat treating temperature (above the transformation range), it appears that furnace cooling produces a more corrosion resistant alloy than air cooling, while from 800°C (below the transformation range) no difference in corrosion rates is evident between furnace and air cooling. Analytical expressions for the corrosion behavior of each heat treatment are presented. (auth)

20160 LR-12970
Lockheed Aircraft Corp., Burbank, Calif.
HIGH ENERGY RATE METAL FORMING. Interim Engineering Report No. 1 [for] Period: October 18, 1957 to February 28, 1958. Includes Appendices I-V: Appendix I. SUMMARY OF HIGH STRENGTH STEEL AND TITANIUM ALLOY SHEET PRODUCTS. (LR-12957). M. Titinsky. Mar. 28, 1958. Appendix II. TENTATIVE ANALYSIS OF SOME PROBLEMS OF FORMING WITH EXPLOSIVES. Report No. (MAS-56). William

Schroeder. PRACTICABILITY OF DETONATION AND SHOCK WAVE ANALYSIS FOR HIGH ENERGY RATE FORMING. Karl G. Eckel. Feb. 14, 1958. (MAS-57). Appendix III. CHEMICAL AND PHYSICAL PROPERTIES OF POWDERS, PROPELLANTS, AND HIGH EXPLOSIVES. Appendix IV. DISCUSSION OF THEORETICAL DIFFERENCES BETWEEN STATICALLY AND DYNAMICALLY (IMPULSIVELY) APPLIED LOADS. Appendix V. BIBLIOGRAPHY. 191p. Contract AF33 (600)-35543. (AD-156722).

An investigation into the application of high rates of energy to the forming of materials difficult or impossible to form by conventional means is presented. A thorough literature survey has been made of the theoretical differences between statically and dynamically applied loads. Twenty-seven organizations were contacted to determine the level of knowledge extent. Their methods of applying high-velocity energy and high hydrostatic pressures have been examined and reported. Materials have been investigated to establish the most likely candidates for future production use. Based upon these studies, conclusions have been drawn and recommendations on materials, tooling, and procedures for the actual testing of Item 2 described. (auth)

20161 MAB-139-M(C1)

National Research Council. Materials Advisory Board. FIRST PROGRESS REPORT BY THE PANEL ON CASTINGS AND POWDER METALLURGY OF THE MATERIALS ADVISORY BOARD COMMITTEE ON THE DEVELOPMENT OF MANUFACTURING PROCESSES FOR AIRCRAFT MATERIALS (AMC). June 19, 1959. 22p. Contract DA-36-039-sc-76436.

A review is presented of projects related to the development of casting and powder metallurgy. In addition, problems related to aircraft metals casting are examined with the aim of developing a well-planned program. (J.R.D.)

20162 MAB-139-M(S2)

National Research Council. Materials Advisory Board. SECOND PROGRESS REPORT BY THE PANEL ON SANDWICH MATERIALS AND JOINING OF THE MATERIALS ADVISORY BOARD COMMITTEE ON THE DEVELOPMENT OF MANUFACTURING PROCESSES FOR AIRCRAFT MATERIALS (AMC). Aug. 3, 1959. 21p. Contract DA-36-039-sc-76436.

A review of problems related to the production of sandwich core materials is presented, and a summary of specifications for fabricators of sandwich construction is given. Investigation of methods other than those being used is recommended as well as consideration of new materials. A summary of the progress in the use of honeycomb structures such as those used in the B-58 is presented, and design requirements for the B-70 and F-108 are discussed. Highlights of general panel discussions on resistance welding and other related matters are included. The status of several projects such as elevated temperature airframe development, fabrication of composite material sandwich panels, use of quartz radiant heat brazing methods, and heliarc welding development is summarized. Future program considerations included diffusion bonding, metal–ceramic joining, ultrasonic bonding, and development of new brazing techniques and alloys. Manufacturing Methods Division criteria for project funding are also summarized. (For preceding period see MAB-139 (S1).) (J.R.D.)

20163 MIL-T-18063A(SHIPS)

Bureau of Ships

MILITARY SPECIFICATION — TUBE AND PIPE, CORROSION-RESISTING STEEL, SEAMLESS AND WELDED, RADIOACTIVE SYSTEM SERVICE. Apr. 11, 1958. 17p.

Specifications are presented for seamless and welded austenitic steel tubes and pipes intended for radioactive system service where general corrosive conditions require corrosion-resisting materials. (J.R.D.)

20164 NAA-SR-3264

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

AN ELEVATING TURNTABLE FOR REMOTE MAINTENANCE IN THE PROCESSING-REFABRICATION EXPERIMENT. Donald J. Stoker. Aug. 15, 1959. 27p. Contract AT-11-1-GEN-8. $1.00 (OTS).

A special in-cell maintenance workbench is required to aid in the remote maintenance of radioactive PRE in-cell equipment. The development and demonstration of such a bench which rotates, moves in a vertical direction, is remotely operable, and has all in-cell components remotely maintainable, is outlined. (auth)

20165 NAA-SR-3411

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

RADIATION BEHAVIOR OF METALLIC FUELS FOR SODIUM GRAPHITE REACTORS. B. R. Hayward and L. E. Wilkinson. Aug. 15, 1959. 35p. Contract AT-11-1-GEN-8. $1.00 (OTS).

Results of irradiation experiments on U–1.2 wt. % Mo and Th–11 wt. % U alloys are presented. These fuel materials were irradiated in temperature-monitored capsules at central metal temperatures of about 1200°F to burnups of about 0.3% of total atoms for the U–Mo alloys and up to 1.14% of total atoms for the Th–U alloys. Post-irradiation measurements revealed total volume increases up to 31% in the U–Mo specimens. The Th–U alloys attained burnups in the order of 1% with total volume increases of 6%. (auth)

20166 NAA-SR-3910

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

CHEMICAL PULVERIZATION OF SINTERED URANIUM DIOXIDE BODIES. PART I. (Preliminary Small-Scale Studies). S. Strausberg and T. E. Luebben. Aug. 1, 1959. 61p. Contract AT-11-1-GEN-8. $1.75 (OTS).

A preliminary study was conducted to develop a nonmechanical method for the pulverization of sintered uranium dioxide fuels suitable for use as an economical procedure for the low decontamination reprocessing of such nuclear fuels. Pulverization of ceramic shapes, to a −400 mesh powder, was accomplished by oxidation to U_3O_8 in air, or pure O_2 (at a reduced pressure). The U_3O_8 was reduced back to UO_2 with hydrogen, or by thermal decomposition at 1200°C in vacuum. The resultant UO_2 powder should be suitable for re-enrichment by dry blending with $U^{235}O_2$, and can be refabricated to high density bodies. The optimum treatment for pulverization of sintered, UO_2 pellets consisted of oxidation, in air at 1 atmosphere pressure, at a temperature of ~375°C. Satisfactory reduction of the finely divided U_3O_8 powder to UO_2 was accomplished in flowing hydrogen, at 1 atmosphere pressure, at about 650°C. (auth)

20167 NASA-TN-D-109

Battelle Memorial Inst., Columbus, Ohio.

EFFECTS OF CREEP STRESS ON PARTICULATE

ALUMINUM–COPPER ALLOYS. E. E. Underwood and G. K. Manning. Sept. 1959. 63p.

Particle dissolution, grain growth, and precipitation were studied under creep conditions in overaged alloys of aluminum with 1, 2, 3, and 4 per cent copper. Particle dissolution, with or without stress, is described by the same kinetic equation that applies to tempering and other phase transformations. The activation energy for dissolution in 3% copper alloys decreases from 70 kcal/mol without stress to 40 kcal/mol for a stress of 200 psi. Relative activation energies for particle dissolution and grain growth coincide closely, suggesting that both are governed by the same process. (auth)

20168 NASA-TN-D-111

Battelle Memorial Inst., Columbus, Ohio.

FATIGUE STRENGTHS OF AIRCRAFT MATERIALS. AXIAL-LOAD FATIGUE TESTS ON EDGE-NOTCHED SHEET SPECIMENS OF 2024-T3 and 7075-T6 ALUMINUM ALLOYS AND OF SAE 4130 STEEL WITH NOTCH RADII OF 0.004 AND 0.070 INCH. H. J. Grover, W. S. Hyler, and L. R. Jackson. Sept. 1959. 26p.

Results of axial-load fatigue tests on specimens, each having a theoretical stress-concentration factor of 4.0, are presented. Tests were run at 0 and 20,000-psi nominal mean stress. The results extend those previously reported for tests on similar specimens and are compared with them. (auth)

20169 NMI-4386

Nuclear Metals, Inc., Concord, Mass.

POWER REACTOR PROGRAM. Progress Report to E. I. du Pont de Nemours and Company for the Period February 1, 1959 through February 28, 1959. S. Isserow, D. F. Kaufman, W. J. Richmond, R. G. Jenkins, W. L. Larson, A. R. Lumbert, A. M. Huntress, and A. R. Kaufmann. June 15, 1959. 35p. Contract AT(30-1)-1565, Sponsor Agreement No. S-31. $6.30(ph), $3.00(mf) OTS.

The processing of Vallecitos enriched tubes was completed. A Vallecitos prototype tube has undergone a total of 100 thermal cycles between 500 and 1000°C with no significant change in dimensions, straightness, or ultrasonic bond strength. No adverse effect on Zircaloy-to-Zircaloy bonds was noted in an experimental power tube extrusion in which the end seal thickness was reduced to the minimum necessary to maintain flowshape control. Work was continued on the heat treatment of power tubes in copper extrusion jackets. The use of scintillation counting as an alternate to radiography for core-end location is under study. Final preparations are being made for the first full-scale driver tube extrusion. Twisting of a flat, coextruded ribbon, Zircaloy-2-clad U–2 wt. % Zr, was accomplished by clamping the flat ribbon at both ends and twisting in a close-fitting Al housing tube. (W.L.H.)

20170 NMI-4393

Nuclear Metals, Inc., Concord, Mass.

POWER REACTOR PROGRAM. Progress Report to E. I. du Pont de Nemours and Company for the Period April 1, 1959 through April 30, 1959. S. Isserow, D. F. Kaufman, W. J. Richmond, W. L. Larson, A. M. Huntress, and J. P. Pemsler. Aug. 14, 1959. 21p. Contract AT(30-1)-1565, Sponsor Agreement No. S-31. $4.80(ph), $2.70(mf) OTS.

The heat treatment of Zircaloy-2 clad power tubes in their copper extrusion jackets is discussed. The extrusion of unalloyed U from six billets is described. The mechanics of beta treatment of extruded tubes in a vertical salt bath were worked out with the aid of a dummy Cu–10 wt.% Ni tube of power tube dimensions. Measurements on the prototype driver tubes indicate that dimensional tolerances can be met in the extruded condition. An attempt is being made to determine the cause of anomalous corrosion behavior of Zr–0.6 wt. %. Ni alloys are melted from Zr sponge. A program is reported on the preparation of slightly enriched U–2 % Zr core, Zircaloy-clad tube for irradiation in the Vallecitos test reactor. (W.L.H.)

20171 NP-7842

Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.

INVESTIGATION OF HIGH TEMPERATURE RESISTANT MATERIALS. Quarterly Report No. 15 [for] May 1, 1959 to July 31, 1959. C. R. Mason, J. D. Walton, M. D. Bowen, and W. T. Teague. 36p. Project No. A-212. Contract NOrd-15701.

Thermal Protection Systems. Thermal conductivity measurements were made on two sets of unfired, slip-cast, fused silica plates. Four sets of fused silica plates were subjected to various firing temperatures, and thermal conductivity measurements were made up to ~1000°F. Four lots of ¾-in.-diam. slip-cast fused silica test bars were fired for 17 hours each at 1700, 1800, 1900, and 2000°F. Fused silica tubes coated with ZrO_2, Al_2O_3, and Invar were tested in the exhaust of the oxyhydrogen rocket motor with cooling water passing through the tubes. Coatings. Using present arc-spraying techniques, ZrO_2 shapes were obtained having 80 to 90% theoretical density, and Al_2O_3 shapes were obtained having 70 to 80% theoretical density. Preliminary values for tensile strength were obtained on HfO_2, ZrO_2, and Al_2O_3 shapes. Thermets. The physical properties of beryllium–chromic oxide thermets fired dual shrouded in graphite and kaolin wool were determined. (For preceding period see NP-7600.) (W.L.H.)

20172 NP-7843

Foote Mineral Co., Berwyn, Penna.

REPORT ON ZIRCONIUM METAL POWDER. G. W. Mao and M. M. Morris. [1959]. For Catalyst Research Corp.

A literature survey on the theoretical and technological aspects of zirconium metal powder has been completed. This report summarizes the methods for preparation, physical and chemical properties, safety control, chemical analysis, and available thermodynamic data on the oxidation and kinetics of some common gases reactions with zirconium. Literature on the fabrication of zirconium powder is not discussed. The bibliography is attached. (auth)

20173 NP-7850

Central Inst. for Industrial Research, Blindern, Oslo, Norway.

OXIDATION OF NIOBIUM. Technical (Scientific) Note No. 1 [for] April 1, 1958 to March 31, 1959. Tor Hurlen, Hallstein Kjöllesdal, Joar Markali, and Nico Norman. Apr. 1959. 126p. Contract AF61(052)-90.

The reaction of niobium with oxygen of pressures from 760 to 10^{-2} torr and temperatures from 150 to 1000°C was studied by means of rate measurements and x-ray diffraction, electron microscopy, and metallographic investigations. (auth)

20174 NP-7856
Battelle Memorial Inst., Columbus, Ohio.
HIGH-TEMPERATURE PROPERTIES AND ALLOYING BEHAVIOR OF THE REFRACTORY PLATINUM-GROUP METALS. R. W. Douglass, F. C. Holden, and R. I. Jaffee. Aug. 14, 1959. 128p. Contract NOnr-2547(00), NR 039-067.

A survey of the literature pertaining to the platinum-group metals and their alloys has been conducted as a part of the study of the metallurgical properties of the refractory platinum-group metals. Major emphasis was placed on the four more refractory metals: rhodium, iridium, osmium, and ruthenium. A selected bibliography and a list of references are included. (auth)

20175 NP-7865
SOVIET ZIRCONIUM. Elias Bacha. Apr. 24, 1959. 10p.

A comprehensive analytical report is presented on Soviet Zr. The occurrence, production, uses, manufacturing methods, and research are reported. (W.L.H.)

20176 NP-7871
Canada. Dept. of Mines and Technical Surveys, Mines Branch.
PREPARATION OF BISMUTH ALLOYS CONTAINING VARIOUS AMOUNTS OF SODIUM AND RUBIDIUM. W. A. Pollard. Jan. 3, 1958. 7p. (IR-58-1).

Preparation and analysis of Bi alloys are described. The sodium alloy contained about 9% of that element, and the rubidium alloys were composed of 3.4, 0.65, and 0.13% Ru. (J.R.D.)

20177 NP-7880
Narmco, Inc., San Diego, Calif.
DEVELOPMENT OF EXO-REACTANT INORGANIC ADHESIVE SYSTEM. Quarterly Progress Report No. 4 covering period: April 1–June 30, 1959. William L. Bassett, William Boram, and Roger A. Long. July 1, 1959. 136p. Contract NOas-58-857-c.

Development of Exo-Reactant Systems was continued with the first successful, weak but promising, bonding of 17-7 stainless steel resulting. Both continuous metal and continuous glass type systems were developed. The glassy systems were farther advanced because of their more favorable wetting tendencies, but the major emphasis was placed on the continuous metal systems because of their greater potential. Moderate wetting was obtained in continuous metal systems such as 6% Mg + 85% Cu_2O + 9% SnO_2 by adding titanium and initial, weak bonding was developed. No lap shear strengths were measured in time for this report. Ignition temperatures as low as 491°F were attained by titanium hydride or lithium hydride additions. Metal continuity was sufficient to provide ductile bonding. Excellent wetting was developed with the glassy system 7% ($Na_2O \cdot 2B_2O_3$) + 17% SiO_2 + 6% B + 70% CuO and cohesive strength was good except for thermal stress cracks. These were minimized by thin bond line development. Several lap shear specimens were successfully, although weakly, bonded. The highest strength obtained was 380 psi. A fairly good pyrotechnic system for use as an external heat source in brazing applications has been developed, the heat source being B–V_2O_5 powder, bound by an organic binder to a pyrophoric matrix. The resultant product is a mechanically flexible, handleable tape, which exhibits good propagative burning, and looks promising from the standpoint of heat energy liberation. (For preceding period see NP-7589.) (auth)

20178 NRL-5333
Naval Research Lab., Washington, D. C.
ELECTROCHEMICAL MECHANISMS OF NOBLE-METAL–HYDROGEN SYSTEMS. PART IV. TRANSPORT OF HYDROGEN AND DEUTERIUM THROUGH METALS. S. Schuldiner and J. P. Hoare. May 1, 1959. 39p. Project NR-475-000.

Parts I, II, and III issued as NRL-5091, NRL-5129, and NRL-5171, respectively.

The electrochemical mechanisms in noble-metal/hydrogen systems are reviewed. Hydrogen isotopes can be transported through palladium by processes such as atomic diffusion and electrochemical migration of cations. These processes were investigated for hydrogen and deuterium, and mechanisms were determined. Preliminary investigations, using palladium-clad electrodes, of hydrogen transport through platinum, nickel, gold, and steel were also carried out. Under the experimental conditions used, transport of hydrogen through nickel and gold did not occur. Hydrogen, however, did dissolve and migrate as protons through platinum, whereas it can either migrate as protons or diffuse as atoms through steel or palladium. (auth)

20179 NRL-5348
Naval Research Lab., Washington, D. C.
CRACK PROPAGATION TESTS OF HIGH-STRENGTH SHEET MATERIALS. PART III. LOW-ALLOY AIR-HARDENING STEEL. J. E. Srawley and C. D. Beachem. July 30, 1959. 15p.

The results of crack propagation tests, using center-cracked sheet tensile specimens, 0.5 inch wide and 0.075 inch thick, are presented for a proprietary, low-alloy, air-hardening steel (0.4% C, Cr–Mo–V), capable of being heat-treated to a tensile yield strength of at least 230 ksi. In this condition of highest strength the fracture-appearance transition temperature (FATT) was 200°F, and the net fracture stress was much less than the yield strength at all temperatures in the range –200 to +500°F. Considerable improvements in these features were obtained by the use of two other tempering treatments, each of which resulted in a yield strength of slightly less than 200 ksi; however, the FATT was still above room temperature in each case. In addition to the tests with center-cracked specimens, some parallel tests were conducted with specimens in which slots with ends having radii of not more than 0.002 inch were used. The fracture-appearance values for such specimens corresponded almost exactly with those for the cracked specimens; on the other hand, the net fracture-stress values differed greatly. This supports the authors' expectation that fracture-appearance measurements may be of much broader usefulness than quantities derived from the maximum load sustained. A section of the report deals with the interpretation of the net fracture-stress values in relation to recent pertinent developments from the Griffith theory. (auth)

20180 ORNL-2760
Oak Ridge National Lab., Tenn.
WELDING OF NICKEL–MOLYBDENUM ALLOYS. G. M. Slaughter, P. Patriarca, and R. E. Clausing. Aug. 25, 1959. 30p. Contract W-7405-eng-26. $4.80(ph), $2.70(mf) OTS.

The use of nickel–molybdenum alloys as structural materials for high-temperature fused-salt reactor systems requires that they be readily weldable. The welded joints must also possess adequate mechanical properties at room and elevated temperatures. This paper describes the welding studies conducted on a commer-

cial alloy, Hastelloy B, and a developmental alloy INOR-8. Hastelloy B is age hardenable, while INOR-8 is immune to this undesirable condition. The influence of aging temperature and time upon the hardness of Hastelloy B welded joints was determined. The tensile properties of all-weld-metal samples of these alloys, both in the as-welded and welded and aged conditions were also determined. Photomicrographs of welds in both conditions are shown. (auth)

20181 ORNL-2762
Oak Ridge National Lab., Tenn.
DENSITIES OF SOME MOLTEN SALT MIXTURES CONTAINING NITRATES. G. Pedro Smith, Guy F. Petersen, and William M. Ewing. Aug. 21, 1959. 8p. Contract W-7405-eng-26. $1.80(ph), $1.80(mf) OTS.

Values of the densities of molten salt mixtures have been determined as needed for the computation of molar extinction coefficients from absorption spectra. Constants in the density function measured during the past eighteen months are reported. (auth)

20182 R58APS116
General Electric Co. Light Military Electronics Dept., Schenectady, N. Y.
RESEARCH ON LIQUID METALS AS POWER TRANSMISSION FLUIDS. Progress Report No. 1 [for] September 1, 1958 to December 15, 1958. R. C. Kumpitsch. Dec. 1958. Project No. 8-(1-7331). Contract AF33 (616)-5917.

Research on liquid metals for use as power transmission fluids concerned with the construction, assembly, and operation of a complete 1 gpm, 3000 psi, 1000°F liquid metals test loop is reported. The feasibility of using the liquid metal NaK-77 as a high-temperature hydraulic fluid is to be investigated by operation of this loop. Construction of the test loop has been initiated. Delivery of all system components and completion of the test loop less the high-pressure NaK pump is scheduled for 15 January 1959. The design of the high-pressure NaK staged gear pump was completed with exception to the selection of materials. The materials compatibility and wear test program was extended for the purpose of determining acceptable bearing, gear, wear plate, and shafts material combinations. Three material combinations were evaluated in NaK-77 at 1000°F for a period of six hours. Test results revealed that Kenametals K-84 running on Kentanium 138A to be the most acceptable combination of the materials evaluated. (auth)

20183 RDB(C)/TN-31
Gt. Brit. Culcheth Labs., Culcheth, Lancs, England.
SOME FACTORS INFLUENCING THE COMPATIBILITY OF METALS WITH SODIUM, POTASSIUM AND URANIUM. A. B. McIntosh, J. S. Broadley, and K. Q. Bagley. Apr. 29, 1953. 48p. (FRDC/P-27).

The various factors which may influence the compatibilities of metals with sodium, potassium, and uranium are considered. Where possible these have been assessed using data which can be calculated or are already available in the literature. By studying the relation between the position of metals in the periodic classification and their compatibilities, it is shown that the most likely constructional metals for a fast reactor fuel element container are to be found in Groups IV, V, and VI. (auth)

20184 SCR-109
Sandia Corp., Albuquerque, N. Mex.
SOME OF THE THINGS THAT ARE KNOWN AND SOME THAT SHOULD BE KNOWN ABOUT PIEZOELECTRIC CERAMIC. T. G. Kinsley. Aug. 1959. 9p. $0.50 (OTS).

The efficiencies of lead zirconate–lead titanate and lead metaniobate systems compared to lead titanate–barium titanate system as a voltage generator and as an energy generator are presented. (W.L.H.)

20185 SCR-110
Sandia Corp., Albuquerque, N. Mex.
RECOMMENDED PROCEDURE FOR EVALUATING PERMANENCY OF RESIDUAL POLARIZATION IN FERROELECTRIC CERAMICS. T. G. Kinsley. Aug. 1959. 5p. $0.50(OTS).

Proposals are presented for determining retentivity of polarization in ferroelectric ceramic elements for different applications. A test procedure is described for elements to be driven at high frequencies and intensities under steady state or pulse conditions, such as those used for delay line application. Test procedures are also presented for elements to be mechanically stressed and for elements working into both high and low impedance loads and subjected to nondestructive high impact and quasi-static stresses. (W.L.H.)

20186 SCTM-206-59(51)
Sandia Corp., Albuquerque, N. Mex.
A SURVEY OF THE LITERATURE ON THE ELASTIC CONSTANTS OF BARIUM TITANATE CERAMICS. Robert A. Graham. June 30, 1959. 14p. $3.30(ph), $2.40(mf) OTS.

A complete set of elastic constants for barium titanate, ceramics A and B, is presented. Certain piezoelectric and physical constants are also given. (auth)

20187 USBM-U-596
Bureau of Mines. Northwest Electrodevelopment Experiment Station, Albany, Oreg.
QUARTERLY METALLURGICAL PROGRESS REPORT NO. 2 FOR THE PERIOD OF JANUARY 1, 1959 TO MARCH 31, 1959. 37p. Contract AT(11-1)-599. $1.25 (OTS).

Yttrium metal production studies are reported. Equipment to produce 20 to 25 kg of Th metal per batch was constructed and tested. The direct reduction of UF_6 with Na in newly designed equipment was started. Development work on air-cooled molds includes the casting of herring-bone-finned Cu tubing. Efforts were directed towards the preparation of high-purity Hf sponge metal by metallic reduction of $HfCl_4$ in an 8-inch-diameter pit-type furnace. Thermal analysis of Zr–Er alloys was run on a limited number of alloys to obtain solid state transformations and solidus temperatures. Several investigations to define alloying characteristics and corrosion properties of Zr or Zircaloy-2 with Er, Gd, Sm and Er, or Sm plus U are being conducted. A series of the Zr–Gd system from 100% Zr to 100% Gd was melted. Phase diagrams of two systems, Ti–Gd and Ti–Ir are being investigated. Hafnium phase diagram studies included the preparation and examination of Zr–Ni metallographic specimens. (For preceding period see USBM-U-550.) (W.L.H.)

20188 USBM-U-623
Bureau of Mines. Albany Metallurgy Research Center, Ore.
QUARTERLY METALLURGICAL PROGRESS REPORT NO. 3 FOR THE PERIOD OF APRIL 1, 1959 TO JUNE 30, 1959. July 1959. 44p. Contract AT(11-1)-599. $1.25(OTS).

Yttrium research was largely confined to the installation and operation of equipment for the preparation of chloride and reduction to sponge at a scale of ~20 pounds of metal. Thorium tetrachloride was prepared on a scale of ~6 kg per batch, purified by vacuum distillation, and reduced to metal in batches of 30 to 60 kg of chloride. Four tests were made employing Na reduction of UF_4. Melting points, both liquidus and solidus, were determined for Zr–Sm alloys. Alloy samples containing 5 to 90% Gd were heat treated at 875 and 950°C to confirm the alpha to beta transformation temperature of Zr–Gd solid solution and to establish solidus points for Gd in both alpha and beta Zr. Investigation of the Zr–Sm phase diagram is reported. The tentative Zr–Dy diagram was revised to conform with more recent data. Solidus temperatures for the Zr–Er system and the extent of solid solubility of Er in Zr and Zr in Er were established. The hot water corrosion resistance of Zr and Zircaloy-2 are adversely affected by additions of Dy and Er. Diagrams for the Ti–Ir and Ti–Gd systems were partially completed. Europium metal was prepared from its oxide. The crystal structure of Hf_2Ni was determined as body-centered tetragonal of the $CuAl_2$ type, but the structures of the other indicated compounds could not be determined. (For preceding period see USBM-U-596.) (W.L.H.)

20189 WADC-TR-58-519

General Electric Co. General Engineering Lab., Schenectady, N. Y.

CURRENT STATUS OF KNOWLEDGE ON DESIGN CRITERIA FOR BEARINGS USED IN HIGH TEMPERATURE AIRCRAFT ELECTRICAL ACCESSORIES. P. Lewis, S. F. Murray, and A. A. Schwartz. Sept. 16, 1958. 58p. Project 6058. Contract AF33(616)-5766. (AD-203792). OTS.

The goal of the investigation is a bearing system capable of operation at 700°F. The problem resolves itself into the proper choice of materials, lubricants, bearing design, and a system which will utilize these successfully. Many materials show promise for this temperature range; the M series tool steels appear to be most desirable based upon requirements. The fluids under consideration fall into the following groups: silicones, silicate esters, silanes, mineral oils, polyphenyls and polyphenyl ethers, fluorinated organic compounds, esters, and polyolefins. These represent a wide range of physical properties which will be utilized in accordance with the choice of a system. Fluids which burn off clean might be more applicable to a "once through" system than a more stable fluid which forms a jamming residue. In the bearing design, loose clearances, open curvatures, and land riding cages seem most desirable. M-50 tool steel bearings containing "S" Monel or Ni resist cages show promise for successful performance. Two systems appear to have the most promise for meeting the specification for a system requiring no external means of lubrication: grease packed bearings and a modified "once through" system. (auth)

20190 WADC-TR-59-404

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

DEVELOPMENT OF PARTIALLY VOLATILE BRAZING FILLER ALLOYS FOR HIGH-TEMPERATURE APPLICATION AND RESISTANCE TO OXIDATION. Final Report covering period April 1, 1958 to March 31, 1959. William M. Lehrer and Harry Schwartzbart. June 30, 1959. 45p. Project title: METALLIC MATERIALS. Task title: WELDING AND BRAZING OF METALS. Contract AF33(616)-5654.

Experimental brazing filler alloys have been developed containing temperature depressants which have been volatilized during the brazing of stainless steel leaving joints of high remelt temperature. The mechanisms by which remelt temperature is increased have been studied for the range of alloys investigated which contained nickel, chromium, germanium, iron, lithium, and phosphorus. The two main mechanisms are (1) dissolution of the base metal in the filler metal and diffusion of constituents of the filler metal into the base metal and (2) volatilization of the filler metal constituents. It has been shown theoretically and experimentally that in order for remelt temperature to increase there must be solid solubility of the diffusing or volatile element in the filler alloy. Although compositional changes may result from either mechanism, a remelt temperature change does not necessarily occur. The degree to which a compositional change affects remelt temperature is proportional to the solid solubility. In this program, vacuum pumping was the more efficient vapor-removal method among several discussed and investigated. Furthermore, under vacuum the surface-area-to-volume ratio of the filler alloy becomes less rate-controlling due to boiling. Boiling, however, causes porosity in the joint. Of the alloys investigated a 61% Ni–39% In alloy exhibited the greatest remelt temperature rise due to volatilization alone, whereas a 94% Ni–6% P responded only to dissolution and diffusion to exhibit the largest rise in remelt temperature due to this mechanism. Ni–Cr–In–Ge alloys exhibited a substantial rise in remelt temperature due to the operation of both mechanisms. This alloy and the binary Ni–In alloy can be considered practical alloys for high-temperature usage. A direct effect of metallic vapors on wetting and flow of the filler alloy was observed and subsequently discussed with respect to their influence on surface tension relationships. It has been shown that in the presence of metal vapors, discoloration of the base metal, wetting, flow, and skull formation of the filler alloy are functions of the rate and quantity of metal vapor removal. (auth)

20191 WAL-TR-341-5/1

Watertown Arsenal Lab., Mass.

NOTCH SENSITIVITY AND LAMINATED CHARPY IMPACT STRENGTH OF 1100-F AND 2024-T4 ALUMINUM ALLOY SIMULATED SHEET. S. V. Arnold. Sept. 1959. 19p. DA Project 5B93-32-003. (PB-151898). $0.75 (OTS).

Simulated sheet of 1100-F and 2024-T4 aluminum alloys were fashioned in 0.050, 0.080, 0.100, 0.133, and 0.200-inch gages by removing equal amounts of stock from each rolled surface of 0.250-inch plate. Laminated Charpy specimens 0.400-inch thick were assembled from this simulated sheet and tested over the range −196 to +400°C. Notched and unnotched tensile specimens were tested at room temperature. (auth)

20192 WAPD-PWR-(RD2)-369

[Westinghouse Electric Corp. Bettis Atomic Power Div., Pittsburgh].

REVIEW AND EVALUATION OF "CREEP AND DEFLECTION TESTS ON ZIRCALOY DIAPHRAGMS." George C. Frazier, Jr. [May 1959]. 14p. $3.30(ph), $2.40(mf) OTS.

Attached to this report is a letter (WAPD-PWR-RD-774) containing pertinent data, from J. Sherman, dated May 13, 1959. 2p.

An investigation of the strength and deflection characteristics of simulated Zircaloy-2 oxide fuel compartments of the preferred shape and size is presented. The test program consisted of an investigation of three facets of the behavior of the square compartment when subjected to an internal pressure. These are: clad pressure-deflection characteristics in the elastic range and the pressure required to rupture the compartment; clad creep at various pressure loadings at both room temperature and reactor operating temperature; and determination of the volume-deflection characteristics of the deformed clad dome when strained well into the plastic region. (W.L.H.)

20193 WAPD-ZH-19

Westinghouse Electric Corp. Bettis Plant, Pittsburgh. ZIRCONIUM HIGHLIGHTS. July 1959. 22p. Contract AT-11-1-GEN-14. $4.80(ph), $2.70(mf) OTS.

Separate abstracts were prepared for each of five papers on the properties and fabrication of zirconium and its alloys. The subjects include plasticity of Zircaloy-2, effects of electron-beam welding on Zircaloy-2, tensile testing errors, effects of cooling rate on corrosion of Zircaloy-2, and Zircaloy-2 impact properties. (J.R.D.)

20194 WAPD-ZH-19(p.1-3)

Westinghouse Electric Corp. Bettis Plant, Pittsburgh. PLASTICITY OF ZIRCALOY-2 UNDER EXPLOSIVE LOADING. W. E. Zupon. p.1-3 of ZIRCONIUM HIGHLIGHTS. 3p.

A summary of results obtained in experiments to determine the relative plasticity of Zircaloy-2 under explosive loading conditions is presented. The alloy was formable under these conditions, and it appears that unusual or limited-quantity parts can be fabricated in this manner. (J.R.D.)

20195 WAPD-ZH-19(p.4-12)

Westinghouse Electric Corp. Bettis Plant, Pittsburgh. SOME EFFECTS OF ELECTRON-BEAM WELDING ON THE PROPERTIES OF ZIRCALOY-2. J. F. Smith and R. E. Johnson. p.4-12 [of] ZIRCONIUM HIGHLIGHTS. 9p.

Methods and effects of electron-beam welding are discussed. It appears that no significant change of composition occurs during welding with the 1 kw Zeiss machine. The effects on the microstructure of Zircaloy-2 are similar to those of tungsten-arc welding. Photomicrographs are included, and descriptions of microstructures are given. (J.R.D.)

20196 WAPD-ZH-19(p.13-15)

Westinghouse Electric Corp. Bettis Plant, Pittsburgh. THE ERRORS ASSOCIATED WITH THE TENSILE TESTING OF ZIRCALOY-2 STRIP. J. G. Goodwin. p.13-15 [of] ZIRCONIUM HIGHLIGHTS. 3p.

The spread of tensile test data obtained from Zircaloy-2 strip was attributed to variations within an ingot, variation between ingots, tensile measurement error, and sponge source. A statistically designed experiment was performed to estimate the magnitude of the first three errors and to find the averages of the process for a single sponge source. Analysis of the data showed that for each tensile property the process is well described by a normal distribution and that there is a significant difference between ingots at the 0.95 probability level. (J.R.D.)

20197 WAPD-ZH-19(p.16)

Westinghouse Electric Corp. Bettis Plant, Pittsburgh. EFFECT OF COOLING RATE ON THE CORROSION RESISTANCE OF ZIRCALOY-2 IN 680°F WATER. D. B. Scott. p.16 [of] ZIRCONIUM HIGHLIGHTS. 1p.

Corrosion coupons were prepared by heating Zircaloy-2 strips to 1832°F and slowly cooling to 1300°F, then cooling with no control to room temperature. After a standard practice preparation these coupons were corrosion tested in 680°F water and 750°F steam for 140 days. Results are discussed and tabulated. (J.R.D.)

20198 WAPD-ZH-19(p.17-20)

Westinghouse Electric Corp. Bettis Plant, Pittsburgh. IMPACT PROPERTIES OF WELDED ZIRCALOY-2. L. S. Rubenstein. p.17-20 [of] ZIRCONIUM HIGHLIGHTS. 4p.

Data are presented from an experiment designed to determine the relative impact property changes of welded vacuum-melted Zircaloy-2 at three test temperatures as functions of notch direction and heat treatment. As-welded Zircaloy shows a reduced capacity to absorb impact energy prior to fracture from that of the base material; however, this capacity may be partially restored by subsequent annealing. The impact energy required for fracture increases rapidly with increasing test temperature from room temperature to 600°F. (J.R.D.)

20199 AAEC/E-27

WORK WITH ALKALI METALS. P. P. Pugachevich. Translated by H. J. de Bruin from Zhur. Fiz. Khim. 31, 2140-2(1957). 6p.

Methods are described for purifying alkali metals in a vacuum and production techniques for alkali metal amalgams. The glass devices used for these purposes have no vacuum taps, ground in stoppers or rubber tubes; thus the purity of the metals and amalgams is not affected by the vapor of the vacuum lubricant, water or otherwise. The alkali metal amalgams produced remained unaltered in quality through years of storage. (auth)

20200 CEA-tr-A-346

CONDUCTIBILITE DES POUDRES MÉTALLIQUES COMPRIMÉES. (Conductivity of Compressed Metal Powders.) O. Kantorowicz. Translated into French from Ann. Physik (5) 12, 1-51(1932). 70p.

The effects of pressure and grain size on the electrical conductivity of metal powders were investigated at pressures up to 4200 atm. The metallic powders studied were Sb, Pb, Fe, Au, graphite, Cu, Ni, Pt, Ag, Bi, W, Zn, and Sn. The resistance of a metallic powder under pressure varies from that of the metal. For soft metals the resistance is lower, and for hard metals it is higher. In compression the powders undergo variations explainable by the phenomenon of hardening. The resistance at a given pressure depends not only on the pressure at the moment but also on the history of this pressure. The resistance and pressure have the relationship $1/R = cP + C$, where c and C are constants closely dependent on the history of the powder. The pressure-resistance curve is irreversible. The increase of resistance depends to a great degree on the duration of pressure. Exceptions to Ohm's law are found for some powders and these are described. The resistance is also dependent on the grain. The temperature coefficient for the resistance is negative at zero pressures, but at high pressures it is dependent on the direction of the temperature variation. Oxide layers do not appear to have any effect. Occasionally at high pressures the powders present the "Kohare" effect. (J.S.R.)

20201 CEA-tr-A-548

TEXTURES DE LAMINAGE ET DE RECRISTALLISATION D'UN ALLIAGE FERRO–NICKEL A 30 % DE NICKEL. (Rolling and Recrystallization Textures of a Ferro–Nickel Alloy with 30% Nickel.) Johanna Grewen, Armin Segmüller, and Günter Wassermann. Translated into French from Arch. Eisenhüttenw. 29, 119-24(1958). 26p.

The rolling and recrystallization textures of an iron–nickel alloy with 30% Ni were determined as a function of the temperature and duration of annealing. A cubic structure and a recrystallization structure were observed at 500°C. These structures increase during temperature rise and longer duration of annealing. In the recrystallized sheets a texture appears which corresponds to the intermediate texture in its orientation. (J.S.R.)

20202 CEA-tr-R-651

RÉSISTANCE CYCLIQUE DES ACIERS AUSTÉNITIQUES A LA CORROSION DES GAZ À HAUTE TEMPÉRATURE. (Cyclic Resistance of Austenitic Steels to Gaseous Corrosion at High Temperatures.) A. V. Ryabchenkov (Riabchenkov) and E. L. Kazimirovskaya. Translated into French by B. Vinogradoff from Metalloved. i Obrabotka Metal. No. 3, 6-10(1958). 12p.

The corrosion caused by combustion products at high temperature and the effect on the endurance of turbine blades were investigated. The steel samples were exposed to a symmetric circular bending at a frequency of 2800 cycles/min in air and various corrosive gaseous media at temperatures from 20 to 650°C. The gaseous media investigated were sulfur dioxide and water vapor. The presence of sulfur dioxide at 650°C decreases the cyclic resistance of steel and increases the slope of the fatigue curve. Sulfur dioxide causes a transformation from uniform corrosion to pitting corrosion. An increase of humidity decreases the unfavorable effects of SO_2. (J.S.R.)

20203 CEA-tr-R-678

MESURE DE LA RÉSISTANCE DES POUDRES À BONNE CONDUCTIBILITÉ DANS LE PROCESSUS DE FRITTAGE. (Measurement of the Resistance of Powders with Good Conductivity during Fritting Processes.) V. N. Kotelkov. Translated into French by B. de Trezvinsky from Zavodskaya Lab. 24, 1095-6(1958). 5p.

A press was constructed which permits the measurement of the electric resistance of metallic powders during fritting by the compensation method and which excludes the effects of chance resistances. A textolite cylinder is divided into three parts by brass compensation electrodes. The pistons are supplied with collars so that the powder depth can be measured directly and the density of the compressed powder can thus be calculated. A graph obtained during a study of the electrical properties graphite–nickel oxide is presented. The relationship between the resistivity and the pressure is derived. (J.S.R.)

20204 CEA-tr-R-696

INFLUENCE DES ÉLÉMENTS D'ADDITION SUR LA RÉSISTANCE À LA CORROSION DES ACIERS AU CHROME–NICKEL–MOLYBDÈNE–CUIVRE DANS LES SOLUTIONS D'ACIDE SULFURIQUE. (Influence of Addition Elements on the Corrosion Resistance of Chromium–Nickel–Molybdenum–Copper Steels in Sulfuric Acid Solutions.) E. V. Zotova. Translated into French by B. de Trezvinsky from Khim. Prom., 239-43 (1958). 15p.

A study was made of the effects of the alloying elements chromium (5 to 27%), nickel (9 to 28%), molybdenum (0 to 3%), copper (0 to 3%), titanium (up to 0.5%), niobium (up to 1.5%), and carbon (0.02 to 0.3%) on the corrosion resistance of steels in 5 to 90% H_2SO_4 at 80°C and in 5 to 50% boiling H_2SO_4. The results showed that chromium, nickel, molybdenum, and copper improve the corrosion resistance to a great degree, but titanium, niobium, and carbon have no effect. The conditions under which the metals improve the corrosion resistance are given. The steels having 5 to 9% chromium and 15% nickel display a fissuring corrosion in 5 to 60% sulfuric acid. The austenite-martensite two-phase steels have a considerably better corrosion resistance in 30% acid at 80°C than the single-phase austenite steels. (J.S.R.)

20205 CEA-tr-X-135

RECHERCHES SUR LA CORROSION. INFLUENCE DE L'HYDROGÈNE SULFURÉ SUR LA CORROSION DE L'ALUMINIUM. (Investigations on Corrosion. Influence of Hydrogen Sulfide on Aluminum Corrosion.) K. Smrček, I. Sekerka, and V. Seifert. Translated into French from Chem. listy 52, 196-200(1958). 14p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 13584.

20206 IGRL-T/CA-112

BRAZING IN VACUUM. F. Bernhard and H. Bumm. Translated by J. Standring (U.K.A.E.A., Risley) from Vakuum-Tech. 7, 153-8(1958). 12p.

A discussion of brazing small parts either in a protective atmosphere or in high vacuum is presented. The advantage of brazing in vacuum over brazing in a protective atmosphere is due to the fact that heating to high temperature in vacuum leads to nearly complete degassing. (J.E.D.)

20207 SCL-T-260

METHODS OF STUDYING THE FACTORS OF INTERGRANULAR SELF-DIFFUSION IN METALS. (Méthodes d'étude et Facteurs de l'autodiffusion Intergranulaire dans les Métaux.) Georges Cizeron. Translated by Marcel I. Weinreich (Sandia Corp.) from Métaux Corrosion–Inds. 32, 315-32(1957). 18p. $3.30(ph), $2.40 (mf) JCL.

The methods utilized in the analysis of the self-diffusion of the intergranular type and in the calculation of the activation energy of the phenomenon are reported. (W.L.H.)

20208

THE TRUE SPECIFIC HEATS OF URANIUM, THORIUM, AND OF OTHER METALS. E. A. Mit'kina. Atomnaya Energ. 7, 163-5(1959) Aug. (In Russian)

The true specific heats of uranium, thorium, beryllium, sodium, and lead–bismuth alloy (43.5% Pb and 56.5% Br) were determined by a cooling–heating method and by the absolute method using an electron-radiative calorimeter. The design of the calorimeter is presented, and the obtained results and previously published data are tabulated. (R.V.J.)

20209

SOLDERS FOR NUCLEAR AND SPACE ENVIRONMENTS. Alvin B. Kaufman (Litton Industries, Los Angeles). Electronics 32, No. 36, 50-1(1959) Sept. 4.

Characteristics of soft and silver solders for use in electronic equipment are presented. (C.J.G.)

20210

HEAT RESISTANT MATERIALS. CHROMIUM–

BRITTLE OR DUCTILE? Ind. Rev. Africa 10, No. 12, 118-19; 121-2(1959) June.

The use of chromium and vanadium as heat-resistant materials is discussed. The important effects in determining the ductile-brittle transition at a critical temperature for various body-centered cubic metals and chromium alloys are enumerated. The use of nitrogen as an embrittling agent is discussed. (C.J.G.)

20211

INVESTIGATION OF Fe–Cr–Ni–Mn QUADRUPOLE SYSTEM. I. I. Kornilov and L. E. Kantorovich (Baikov Inst. of Metallurgy, Academy of Sciences, U.S.S.R.). Izvest. Akad. Nauk S.S.S.R., Otdel. Khim. Nauk No. 6, 963-70(1959) June. (In Russian)

Electroconductivity, hardness, and microscopic analyses were made of the triangle section of Cr–Fe–Mn–Ni alloy. The distribution of α, $\alpha + \gamma$, γ, and σ phase areas in the iron angle of the cross section was established and a phase diagram was plotted. The relation was found between hardness and electric conductivity changes and the phase structure. High ohmic resistance was observed in alloys of 49.7% Mn, 38% Cr, 5% Ni, and Fe. Fifteen different phase areas were found in the studied section of the alloy. (R.V.J.)

20212

INVESTIGATION OF METALLIC COMPOUNDS PRESENT IN MULTICOMPONENT NICKEL ALLOYS HAVING VARIABLE TITANIUM–CARBIDE CONTENTS. R. B. Golubtsova and L. A. Mashkovich (Inst. of Metallurgy, Academy of Sciences, U.S.S.R.). Izvest. Akad. Nauk S.S.S.R., Otdel. Khim. Nauk No. 6, 971-4(1959) June. (In Russian)

Investigations and electro-chemical separation were carried out with saturated phases formed in hexacomponent nickel solid solutions (Al–Cr–Mo–Nb–Ni–W) with various TiC contents. The saturation phase does not separate in anode dissolution of alloys containing 0.1% TiC, confirmed by microstructure data and x-ray analysis. The appearance of only two phases: the γ nickel solid solution phase and complex carbide phase of composition [Ti(Cr, Mo, Nb, and W)C] was observed in alloys containing 1.0, 4.0, and 7.5% TiC. The observed carbide phase has a cubic grain-centered lattice which responds to the carbide titanium lattice with parameter changes from 4.38 to 4.33 kX in relation to the changing of Nb and TiC content. (R.V.J.)

20213

EFFECTS OF GAS CONTENT IN MELTS ON THE HOT-SHORTNESS OF ALUMINUM ALLOYS. G. A. Korol'kov and I. I. Novikov (Moscow Inst. of Non-Ferrous Metals and Gold). Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk Met. i Toplivo No. 2, 19-23(1959) Mar.–Apr. (In Russian)

The hot-shortness of aluminum alloys is considerably lowered with an increase of gas content. The wider the crystallization range the less the hot shortness in alloys with identical gas content. Vacuum degasification increases the hot shortness of aluminum alloys. (R.V.J.)

20214

EFFECTS OF Al, Cr, AND Mo ON THE STRENGTH OF COBALT AND NICKEL BASE ALLOYS. A. I. Baranov, K. A. Bystrova, T. A. Novikova, and V. F. Funke. Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk Met. i Toplivo No. 2, 43-7(1959) Mar.–Apr. (In Russian)

The effects of Al, Cr, and Mo on the stability of WC–Co and WC–Ni alloys were studied in relation to the alloying content, binding phase, and temperature. The highest stability at elevated temperature was found with a complex binding phase composition and comparably low concentration of alloying materials (3 to 7% Cr and Mo and 1 to 2% Al in relation to the binding metal). (R.V.J.)

20215

CREEP DEFORMATION IN NICKEL. E. A. Minkina, N. V. Preobrazhenskaya, and V. M. Rosenberg. Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk Met. i Toplivo No. 2, 48-55(1959) Mar.–Apr. (In Russian)

Grain deformations caused by slipping and by grain transition (in relation to each other) were studied using Ni containing 0.02% C, 0.04% Mn, 0.006% P, 0.006% S, and 0.08% Ti, and traces of Al and Fe. The activation energy in grain transition at 600 to 800°C and 4 kg/mm^2 pressure is 36 kcal/mol which is 1.5 to 2 fold higher than the activation energy in nickel volume self-diffusion and close to the self-diffusion at the boundary. (R.V.J.)

20216

CHANGES IN METAL SUBSTRUCTURE UNDER ALTERNATING STRAIN. M. Ya. Gal'perin, E. P. Kostyukova, and B. M. Rovinskiĭ (Machine Building Inst., Academy of Sciences, U.S.S.R.). Izvest. Akad. Nauk S.S.S.R. Otdel. Tekh. Nauk Met. i Toplivo No. 2, 56-61(1959) Mar.–Apr. (In Russian)

Substructure changes under alternating strain were studied in annealed pure aluminum (99.99%) and electrolytic nickel. (R.V.J.)

20217

EFFECTS OF VARIOUS ELEMENTS ON THE SURFACE TENSION OF ALUMINUM ALLOYS. L. Kubichek. Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk Met. i Toplivo No. 2, 96-103(1959) Mar.–Apr. (In Russian)

The effects of 28 elements (B, Ba, Be, Bi, Ca, Ce, Cd, Cr, Cu, Ge, In, La, Li, Mg, Mn, Mo, Nb, Pb, Sb, Si, Sn, Sr, Ta, Ti, V, W, Zn, Zr) on the surface tension of aluminum–copper (5% Cu) and aluminum–magnesium (10.6% Mg) at 700°C were investigated. (R.V.J.)

20218

SURFACE TENSION AND DENSITY OF LIQUID CHROMIUM. V. N. Eremenko and Yu. V. Naidich. Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk Met. i Toplivo No. 2, 111-12(1959) Mar.–Apr. (In Russian)

The surface tension and density were measured in liquid chromium by the quiescent drop method. The mean liquid chromium density if $\rho = 6 \pm 0.13$ g/cm^3, and the mean surface tension in 1950°C hydrogen is $\sigma = (1590 \pm 50)$ erg/cm^2. (R.V.J.)

20219

ALLOYING BORIDE SYSTEMS WITH SILICON. K. I. Portnoi, G. V. Samsonov, and K. I. Frolova. Izvest Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk Met. i Toplivo No. 2, 117-21(1959) Mar.–Apr. (In Russian)

A method is suggested for improving the heat resistance of boride systems by alloying them with silicon or high-melting metallic silicides. It is shown that relatively small additions of elementary silicon or silicides are sufficient. The admixture of silicides improves the oxidation resistance of the material, while silicon improves its sintering resistance. (R.V.J.)

20220

STUDIES OF TERNARY Mg–Mn–Th SYSTEM. M. E. Drits, M. V. Mal'tsev, and E. M. Padezhnova. Izvest. Akad. Nauk S.S.S.R., Otdel., Tekh. Nauk Met. i Toplivo No. 2, 121-3(1959) Mar.–Apr. (In Russian)

The magnesium angle was studied in a ternary constitution diagram of magnesium–manganese–thorium alloy with 3% Mn and 9% Th. The alloy was subjected to microanalysis, x-ray diffraction, and thermal analysis. Isothermal diagrams for temperatures of 550, 500, 400, 300, and 200°C and polythermal diagrams (at constant thorium content 1, 2, and 3% and manganese 0.5 and 2%) were plotted. (R.V.J.)

20221

COEFFICIENTS OF SOFT X RAY WEAKENING IN BERYLLIUM. D. M. Zhukovskaya and Yu. K. Ioffe (State Office of Radiotechnical Industry, Leningrad Council of National Economy). Izvest. Akad. Nauk S.S.S.R., Ser. Fiz. 23, 541-4(1959) May. (In Russian)

Measurements were made of beryllium values μ/ρ for soft x rays (2.3 to 0.7 A), and the results were correlated with published data. The values I/I_0 were tabulated for various thicknesses. The scheme of the apparatus used is included. It was found that the μ/ρ values for 5 to 10 kev soft x rays (2.3 to 1.5 A) differ 1.5 fold from published data. (R.V.J.)

20222

EFFECTS OF ALLOYING ELEMENTS ON THE KINETICS OF CRYSTAL STRUCTURE OF NICKEL BASE ALLOYS. E. E. Zasimchuk, G. V. Kurdyumov, and L. N. Larikov (Inst. of Metal Physics, Academy of Sciences, Ukrainian S.S.R.). Izvest. Akad. Nauk S.S.S.R., Ser. Fiz. 23, 615-19(1959) May. (In Russian)

The effects of alloying elements (Al, C, Cr, Mo, Nb, Ta, and Ti) on recrystallization kinetics in nickel alloys were determined. (R.V.J.)

20223

STUDIES OF X RAY LINE WIDTH OF METALS DEFORMED AT VARIOUS TEMPERATURES. N. N. Davidenkov and B. I. Smirnov (Leningrad Inst. of Physics and Tech., Academy of Sciences, U.S.S.R.). Izvest. Akad. Nauk S.S.S.R., Ser. Fiz. 23, 624-8(1959) May. (In Russian)

X-ray-diffraction analyses were made of cubic-centered iron and tungsten and face-centered nickel at various temperatures (20 to 400°C). (R.V.J.)

20224

INVESTIGATIONS OF STEEL X RAY MICROBEAMS, DEFORMED AT VARIOUS RATES AT ELEVATED TEMPERATURES. M. Ya. Fuks and L. Ya. Gol'dshteĭn. Izvest. Akad. Nauk S.S.S.R., Ser. Fiz. 23, 629-34(1959) May. (In Russian)

The carbon steel fine structure was studied with x-ray microbeams before and after expansion at room temperature and 450°C. (R.V.J.)

20225

X-RAY STUDIES OF THE INTERBOUND PROCESSES OF CONVERSION, RECRYSTALLIZATION AND ORDERING IN Fe–Co AND Ni–Fe ALLOYS. M. M. Borodkina, E. I. Detlaf, and Ya. P. Selisskiĭ (Baikov Inst. of Metallurgy, Academy of Sciences, U.S.S.R.). Izvest. Akad. Nauk S.S.S.R., Ser. Fiz. 23, 640-2(1959) May. (In Russian)

The results are given of x-ray studies made under intermittent temperature conditions of conversion in Fe–Co alloys and of the initial recrystallization stages in Fe–Co and Ni–Fe alloys. X-ray pictures are shown of the cold deformed Fe–Co with 42% Co taken at 650 to 800°C and Ni–Fe with 65, 70, 75, 80, and 100% Ni after thermal treatment at 350 to 570°C. (R.V.J.)

20226

X-RAY ANALYSIS OF THE CHANGES IN THE NICHROME ALLOYS DURING ANNEALING. L. Kh. Pivovarov and Ya. S. Umanskiĭ (Moscow Inst. of Steel). Izvest. Akad. Nauk S.S.S.R., Ser. Fiz. 23, 646-8(1959) May. (In Russian)

Measurements were made of the changes taking place in Nichrome (Al–0.76, C–0.045, Cr–21.1, Fe–0.32, Mn–0.33, Si–0.58, Ti–2.47 wt. %, remainder nickel) during annealing at 1080°C for 8 hours and at 1250°C for 16 hours. (R.V.J.)

20227

STRUCTURAL CHANGES IN Ni–Be ALLOYS DURING ANNEALING AND HIGH-TEMPERATURE TEMPERING. N. N. Buĭnov. Izvest. Akad. Nauk S.S.S.R., Ser. Fiz. 23, 648-9(1959) May. (In Russian)

Studies were made of the changes taking place in the matrix of saturated metallic solid solutions of Ni–Be (1.9% Be) after annealing and high-temperature tempering. An anomalous diffractional, two-dimensional effect was observed in x-ray diffraction analysis after annealing at 425 to 500°C for 15 min. With increased annealing time the intensity of the effect rapidly increased. (R.V.J.)

20228

X-RAY INVESTIGATIONS OF Re–Mo ALLOYS. N. V. Ageev and V. Sh. Shekhtman (Baikov Inst. of Metallurgy, Academy of Sciences, U.S.S.R.). Izvest. Akad. Nauk S.S.S.R., Ser. Fiz. 23, 650-1(1959) May. (In Russian)

Investigations were made of the formation and structure of σ and χ phases in binary rhenium alloys. Four single phase areas corresponding to two solid solutions of Re–Mo and two intermetallic compounds are found on the plotted diagram. Re solubility in Mo is from ~30% at 2300°C to 24% at 1100°C. The homogeneous σ phase is at ~50 to 70%. The scheme of σ phase ordering for $Re_{18}Mo_{12}$ is tabulated. (R.V.J.)

20229

THE FINE STRUCTURE PROPERTIES OF ALLOYS WITH ANOMALOUS ELECTRIC CONDUCTIVITY. E. N. Vlasova (Central Research Inst. of Ferrous Metals). Izvest. Akad. Nauk S.S.S.R., Ser. Fiz. 23, 655-6(1959) May. (In Russian)

An x-ray structural analysis was made of monocrystalline alloys for determining the redistribution of atoms in disordered solid solutions which leads to the K state. Alloys with 10 wt. % Al at the boundary between ordered (Fe_3Al) and disordered solid solutions, with a maximum of electric resistance during tempering, and the single phase disordered alloys with 6 to 8 wt. % Al were studied and correlated to ordered 12 wt. % Al alloys. (R.V.J.)

20230

TRUE TEMPERATURE OF SATURATED SOLID SOLUTION INITIAL RECRYSTALLIZATIONS. S. S. Gorelik (Moscow Inst. of Steel). Izvest. Akad. Nauk S.S.S.R., Ser. Fiz. 23, 657-9(1959) May. (In Russian)

Studies were made of copper, iron, and nickel base alloys deformed 50 to 70% and annealed for an hour at various temperatures from 300 to 900°C. (R.V.J.)

20231

THE AVAILABILITY, RECOVERY AND PROPERTIES OF RHENIUM METAL. Ivor E. Campbell (National Steel Corp., Weirton, W. Va.); D. M. Rosenbaum (North American Aviation, Inc., Columbus, Ohio); and B. W. Gonser (Battelle Memorial Inst., Columbus, Ohio). J. Less-Common Metals 1, 185-91(1959) June.

Rhenium, a relatively new and unknown metal, is inherently rare and probably will continue to be expensive.

However, at least a few thousand pounds can be readily obtained yearly as a by-product from molybdenum concentrates. Its extremely high melting point and good metal properties indicate a growing use for those applications where a relatively high cost can be tolerated. Uses in the electronics industry, as an electrical contact material, alloyed with tungsten and with molybdenum, and for high temperature thermocouples are among potential industrial applications. (auth)

20232

THE URANIUM MONOCARBIDE–URANIUM MONONITRIDE SYSTEM. J. Williams and R. A. J. Sambell (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Less-Common Metals 1, 217-26(1959) June.

The system uranium monocarbide–uranium mononitride has been investigated by metallographic and x-ray diffraction techniques. Alloys were prepared by arc-fusion and by solid-state diffusion. From the lowest temperature investigated, 1200°C, upwards, the carbide and nitride form a continuous series of solid solutions. At 1200°C the alloys prepared by solid-state diffusion obey Vegard's law but those prepared by fusion deviate from this law in a systematic fashion. The results of x-ray diffraction studies of the diffusion process suggest that homogenization occurs by solution of the carbide in the nitride, but not by the reverse process. Uranium mononitride decomposes when melted in the argon-arc. An atmosphere containing 66% nitrogen does not suppress decomposition entirely. Uranium monocarbide quenched from the melting point has a cell-size ~0.1% less than that of the same material annealed at 1200°C. (auth)

20233

KINETIC STUDY OF THE TRANSITION OF THE CRYSTALS OF TWO-PHASE SOLID SOLUTION METALLIC ALLOYS FROM THE COLLOIDAL TO THE TRUE HOMOGENEOUS STATE. V. N. Vigdorovich and V. M. Glazov (Kalinin Inst. of Non-Ferrous Metals and Baĭkov Inst. of Metallurgy, Academy of Sciences, U.S.S.R.). Kolloid. Zhur. 21, 405-12(1959). (In Russian)

An experimental kinetic study was made of the transition of crystals of two-phase solid solution alloys from the quasi-homogeneous to the true homogeneous state as illustrated by the metallic systems copper–titanium and copper–zirconium. The activation energy of the process was determined for the above systems and a correlation was established between the heats of solution of titanium in copper and copper in zirconium. A possible mechanism for the process was suggested. The transition of the colloidal solution, formed by particles of the second phase in solid solution crystals of two-phase alloys, to a true solution takes place by coalescence of the particles microheterogenizing the solid solution or, in other words, through solution of the smaller particles and growth of the larger ones. (auth)

20234

EFFECTS OF REPEATED HEATING AND COOLING ON STEEL AND ALLOY PROPERTIES. S. T. Kishkin and A. A. Klypin. Metalloved. i Termichesk. Obrabotka Metal. No. 5, 15-19(1959) May. (In Russian)

The effects of cyclic heating and cooling on the mechanical properties of various steels at 550, 700, and 850°C were studied. With cyclic heating above 780°C and cooling, the strength of the steel dropped with the increase of carbon. The strength of the material was impaired by microcracks formed on the surface. In the alloy EI437 the cracks appear exclusively on the grain boundaries while in the rest of the materials they appeared along the grain itself. (R.V.J.)

20235

THE EFFECTS OF TEMPERATURE ON IRON–MOLYBDENUM AND NICKEL–MOLYBDENUM HARDNESS. M. G. Lozinskiĭ and E. P. Sinodova (Inst. of Machine Building, Academy of Sciences, U.S.S.R.). Metalloved. i Termichesk. Obrabotka Metal. No. 5, 35-40(1959) May. (In Russian)

Experiments were carried out with iron alloys containing 4% and 12% Mo and nickel alloys with 7% and 25% Mo. Constitution diagrams show that Fe–4% Mo and Ni–7% Mo remained in one phase at all tested temperatures while Fe–12% Mo and Ni–25% Mo had two phases. Following the transition from the one-phase state, it tends to dispersed hardening. It was found that the concentration of alloying material converting the alloy into the two-phase state improves strength at all tested temperatures. (R.V.J.)

20236

SULFUR EFFECTS ON MECHANICAL AND HEAT PROPERTIES OF PERLITE CAST STEEL. A. F. Silaev and E. F. Dubrovskaya (Central Inst. of Research in Machine Tech.). Metalloved. i Termichesk. Obrabotka Metal. No. 5, 40-4(1959) May. (In Russian)

The effect of sulfur (0.010, 0.030, and 0.066%) on the heat resistance of 15 X 1M1FB steel (0.18% C, 1.42% Cr, 0.61% Mn, 1.20% Mo, 0.51% Nb, 0.12% Ni, 0.012% P, 0.30% Si, and 0.33% V) was studied. The presence of up to 0.066% of sulfur considerably reduces the plastic ductility, impact viscosity, and friability of steel at elevated temperatures. In steels designed for work at 580 to 610°C, the admixture of sulfur should not exceed 0.020 to 0.025%. (R.V.J.)

20237

RELAXATION RESISTANCE OF HIGH-CHROMIUM STEEL. Z. N. Petropavlovskaya, A. M. Borzdyka, and A. V. Merlina (Central Research Inst. of Ferrous Metallurgy). Metalloved. i Termichesk. Obrabotka Metal. No. 5, 45-50(1959) May. (In Russian)

Tests were made to determine the alloying and phase effects on high chromium semi-ferrite steel (0.10 to 0.15% C, 10 to 12% Cr, 0.3 to 0.6% Mo) relaxation. It was found that additions of 0.4% Nb, 0.8% V, and 0.8% W introduced together or separately increase the relaxation resistance of the tested steel. The best results were found when all three elements were added. (R.V.J.)

20238

EFFECTS OF BORON ON THE TEMPER EMBRITTLEMENT OF CONSTRUCTION STEEL. A. M. Tarasov (Gor'kii Automobile Plant). Metalloved. i Termichesk. Obrabotka Metal. No. 5, 54-7(1959) May. (In Russian)

Small admixtures of boron do not increase the irreversible temper embrittlement of the steel. Optimum quantities close to 0.003% B improve the steel, reducing its tendency towards irreversible temper embrittlement. With an increase of the content of B the tendency to temper embrittlement increases. (R.V.J.)

20239

THE OPTICAL REFRACTION OF TITANIUM–ZIRCONIUM SILICATE GLASS. M. A. Bezborodov and I. S. Kachan. Nauch. Doklady Vysshei Shkoly Khim. i Khim. Tekhnol. No. 3, 572-5(1958).

Titanium–zirconium silicate glass was investigated by measuring its optical refraction. The determination of the optical refraction was carried out by means of

the immersion method. The results obtained showed that in the mutual exchange of SiO_2 in glass with ZrO_2 and ZrO_2 with TiO_2 an increase in the optical refraction takes place. The quantitative dependence of the partial quantity TiO_2 for the optical refraction index upon the content of SiO_2 in silicate glass was shown. An empirical formula suggested for $\overline{N}_{TiO_2}$ in zirconium silicate glass is $\overline{N}_{TiO_2} = 2.25 - 0.0035$ (A-50), where A denotes the SiO_2 content in mole %. (auth)

20240

ON THE EFFECT OF THE PHASE COMPOSITION ON THE MECHANICAL STRENGTH OF CORUNDUM CERAMICS. P. P. Budnikov, I. A. Bulavin, and I. A. Zakharov. Nauch. Doklady Vysshei Shkoly Khim. i Khim. Tekhnol. No. 3, 576-9(1958).

The effect of the phase composition on the mechanical strength of corundum ceramics, especially in regard to porosity, was investigated. The strength of corundum ceramic products depends on the glass phase. With an increase in the amount of the glass phase (more than 40%) the porosity increases, which reduces the strength of the body. The samples were also investigated with respect to their microhardness, and the phase composition was determined by microphotography. The microhardness of the glass phase depends on the Al_2O_3 content. The mechanical strength of the ceramic bodies increases linearly according to the Al_2O_3 content in the glass phase. The dependence of the strength and the porosity on changes in the content of the glass phase was investigated along with the influence of other oxides such as CaO, BaO, and FeO_2, on the strength of corundum ceramics. When present in smaller amounts these oxides do not influence the strength. (auth)

20241

GENERALIZATION OF THE EQUATION FOR THE TRANSFER OF MASS. V. V. Kafarov. Nauch Doklady Vysshei Shkoly Khim. i Khim. Tekhnol. No. 3, 595-7 (1958).

A general equation for the mass transfer was formulated by means of which the analyses in diffusion apparatus can be calculated. At a given hydrodynamic state, luminary, turbulent, or freely developed turbulent, the factor for the dynamic state of the surface can be calculated by the formula

$$f = \frac{\Delta p_{gas\text{-}liq.} - \Delta p_{gas}}{\Delta p_{gas}} = \beta \left(\frac{L}{G}\right)^3 \times \left(\frac{\gamma_{gas}}{\gamma_{liq.}}\right)^b \times \left(\frac{\mu_{liq.}}{\mu_{gas}}\right)^c .$$

When the hydrodynamic condition is not fixed, the equation for the mass transfer is $\frac{Nu}{[1 + f] \times Pr^n} = \phi$. (auth)

20242

THERMAL ANALYSIS OF THE SYSTEM $BeCl_2 - BeF_2$. O. N. Kuvyrkin, O. N. Breusov, and A. V. Novoselova. Nauch. Doklady Vysshei Shkoly Khim. i Khim. Tekhnol. No. 4, 660-3(1958).

Thermal investigation of the $BeCl_2 - BeF_2$ leading to a phase diagram is reported. Beryllium hydroxide was converted into beryllium oxide by annealing at 1000°C and then converted into beryllium chloride by chlorination with carbon tetrachloride at 1000°. Beryllium fluoride is obtained by thermal decomposition of $(NH_4)_2BeF_4$ in vacuum. The thermal analysis of the system $BeCl_2 - BeF_2$ was carried out by means of Kurnakov PK-52 pyrometer with platinum-platinum-rhodanid. The fluorides and chlorides of beryllium form a simple eutectic with the composition 72.5 mole % BeF_2, and a melting point at 306°C. The thermal analysis shows a weak endothermal effect at 110°C, which indicates the transformation of unstable beryllium fluoride into a highly stable form. The melting point of beryllium fluoride is 421°C. The heating curves of the samples show effects at temperatures higher than the liquidus temperature, which indicates the boiling of the $BeCl_2 - BeF_2$ melt. (TCO)

20243

SYNTHESIS AND INVESTIGATIONS OF PROPERTIES OF HIGHLY REFRACTIVE ZIRCONIUM–BARIUM GLASSES. M. A. Bezborodov and N. N. Yermolenko. Nauch. Doklady Vysshei Shkoly Khim. i Khim. Tekhnol. No. 4, 768-72(1958).

Synthesis of highly refractive glasses was investigated. For the synthesis of the experimental glasses the phase diagram of the system $Na_2O - BaO - SiO_2$ was taken, into which an increasing quantity of zirconium dioxide was introduced instead of SiO_2. The maximum content of ZrO_2 is 24%. The light refraction of the glasses increases with the increase of the zirconium oxide and barium oxide content. The crystallizability of the glasses was investigated, and it was found that those containing 8 to 16% zirconium dioxide are the most resistant to crystallization. Laboratory experiments were carried out with the addition of CaO and K_2O. Glass properties such as crystallizability, refractive index, chemical stability, softening temperature, and thermal expansion were investigated. (TCO)

20244

STEEL FOR REACTORS AND PROCESSING PLANTS. B. Watkins (Culcheth Labs., Lancs, Eng.). Nuclear Eng. 4, 296-303(1959) July-Aug.-Sept.

Physical, chemical, and mechanical properties and irradiation effects on ferritic (mild), low-alloy Cr–Mo, and stainless steels are examined. (C.J.G.)

20245

EFFECT OF ALPHA-BETA THERMAL CYCLING ON URANIUM AND ITS ALLOYS. B. R. Hayward (Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.). Nucleonics 17, No. 8, 74-7(1959) Aug.

Thermal cycling materials which contain above 90% uranium through the $\alpha - \beta$ transition temperature (660°C) show dimensional instability. The thermal tests conducted were fast cycling by rapid quenching and slow cycling in a furnace. Cold-pressed and sintered alloys were generally much more stable than hot-pressed alloys. (C.J.G.)

20246

THE HARDENING OF COPPER BY NEUTRON IRRADIATION. M. A. Adams and P. R. B. Higgins (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Phil. Mag. (8) 4, 777-80(1959) June.

Copper wires of 0.060 in. diameter were irradiated at 50°C for 1 to 3 weeks. At a fixed neutron dose and testing temperature the yield stress of irradiated polycrystalline copper increases within accuracy limits of experimental measurements. Lattice friction hardening and source hardening proceed simultaneously. The increased yield strength of irradiated copper at −78°C compared with 20°C arises from a temperature dependence of the lattice friction component of hardening. (C.J.G.)

20247

THE GEOCHEMISTRY OF RARE EARTH ELEMENTS. V. I. Gerasimovskiĭ (Veradskiĭ Inst. of Geochemistry,

Moscow). Priroda 48, No. 6, 19-26(1959) June. (In Russian)

A review is given on the geochemistry of rare minerals and their origin, properties, and distribution in the earth's crust. (R.J.V.)

20248

GRAIN REFINEMENT OF SOLIDIFYING METALS BY VIBRATION. R. G. Garlick and J. F. Wallace (Case Inst. of Tech., Cleveland). Trans. Am. Foundrymen's Soc. 67, 9p.(1959).

A number of different liquid metal compositions, including pure metals and alloys that solidify as solid solutions and eutectics, were vibrated under controlled solidifying conditions. Metallographic examination of the solidified ingots of these metals indicated that all were grain refined to some extent, although the amount of refinement varied considerably. The grain refinement increased for those metals exhibiting the larger solidification contraction. Data in technical literature generally confirmed this finding. This latter fact provides substantiation of the theory that vibration, with its alternate high and low pressure waves, increases the nucleation rate of the solidifying phases. Mechanisms that describe how this grain refinement is caused by vibration during the solidification of pure metals, solid solutions, and anomalous eutectics are discussed. (auth)

20249

SOME IMPORTANT FIELDS FOR THE APPLICATION OF COMPOUNDS OF RARE-EARTH ELEMENTS. G. V. Samsonov. Tsvetnye Metal. No. 2, 58-9(1959).

Applications of high-melting compounds of rare earth elements are discussed briefly. Borides of the general type MeB_6, oxides, sulfides, and silicides are considered. It is recommended that more attention be paid to these compounds by metallurgists and economists, that their production be centrally organized, and that accumulated experience in their use be disseminated. (TCO)

20250

STUDIES OF ANTIMONY RHODIUM ALLOYS. N. N. Zhuravlev, Pak Gvan O, and R. N. Kuzmin. Vestnik Moskov. Univ. Ser. Mat., Mekhan., Astron., Fiz. i Khim. 13, No. 5, 79-82(1958). (In Russian)

Three compounds, $RhSb_3$, $RhSb_2$, and RhSb, were found on the antimony–rhodium melting diagram. The compound $RhSb_2$ crystallized into monoclinic syngony with the following parameters: a = 6.6 ± 0.2 A, b = 6.4 ± 0.2 A, c = 6.7 ± 0.2 A, and $\beta = 117 \pm 1°$; $\sigma_x = g/cm^3$. The elementary nucleus is composed of 8 atoms of antimony and 4 atoms of rhodium. The spatial group is $C_{2h}^5(P2_{1/c})$. (R.V.J.)

20251

INVESTIGATIONS OF MAGNESIUM–CADMIUM ALLOYS. IV. STUDIES OF ELECTRIC RESISTANCE OF $MgCd_3$. L. S. Dyubakova, V. A. Kholler, and K. G. Khomyakov. Vestnik Moskov. Univ. Ser. Mat., Mekhan., Astron., Fiz. i Khim. 13, No. 5, 193-200(1958). (In Russian)

The electric conductivity of $MgCd_3$ alloys with 77.2, 75.9, 73.0, and 71.5 at. % Cd was studied at room temperature to 120°C and temperatures of transitions from ordered to disordered states. Transition temperature increases from 80 to 105°C with the decrease of Cd content from 76 to 70 at. %. (R.V.J.)

20252

RADIOACTIVE TRACER STUDIES ON THE CORROSION RESISTANCE OF SOLID SOLUTIONS OF METALS. II. THE SYSTEM Mg–Cd. N. N. Gratsianskii and P. F. Kaluzhnaya (Inst. of General and Inorganic Chemistry, Kiev). Zhur. Fiz. Khim. 33, 997-1001(1959) May. (In Russian)

A study was made of the formation of a surface layer on Mg–Cd alloys in 0.1N H_2SO_4 at room temperature. The radioactive isotope Rb^{86} was used to determine the depth of the micropores at the metal and alloy surfaces. As a result the following mean values for the depths of the micropores before corrosion were obtained: Mg ~ 1μ, Cd ~ 1μ, and Mg–Cd alloy from 1 to 2μ. After corrosion the depth of the micropores increased 2 to 3 fold in the case of the unstable metals and showed almost no change in the case of stable metals. The isotope Cd^{115} was added in determining the corrosion process in the alloy. In non-aggressive media, where almost no corrosion is observed, isotopic exchange is observed only between the surfaces of the metals and their ions in the solution. In aggressive media a dense surface corrosion layer almost 10 μ thick is formed, about 1 μ of which is almost pure Cl, the subsequent layers being a Cd enriched alloy. With corrosionable alloys a corrosion surface layer is also formed, the thickness of which may be changed during the entire course of the corrosion process. In some cases a loose skeleton of crystals remaining, whereas in others the remaining atoms of the stable component, losing connection between each other, pass over into the solution. The thickness of the surface layer of Mg–Cd alloys to which the radioactive isotopes penetrate corresponds to the thickness of the corrosion layer formed. (auth)

20253

INVESTIGATION OF THE ELECTROCAPILLARY PHENOMENA IN BISMUTH–CADMIUM ALLOYS AND OF THE SURFACE TENSION OF THE ALLOYS IN VACUUM. V. A. Kuznetsov, T. D. D'yakova, and V. P. Mal'tseva (Gor'ki Ural State Univ., Sverdlovsk, U.S.S.R.). Zhur. Fiz. Khim. 33, 1551-9(1959). (In Russian)

A study was made of the electrocapillary phenomena in Cd–Bi alloys and of the surface tension of these alloys in vacuum at 450°C. Increase in concentration of bismuth in the alloy was shown to lower the surface tension of the latter both at the electrolyte interface and in vacuum. Calculations were made of the adsorption Γ_{Bi} at the alloy-electrolyte interface at the potential maxima of the electrocapillary curves, and it was shown that the shift of the maximum is linearly related to the surface concentrations of bismuth. Results of the surface tension measurements of the alloys in vacuum were examined in the light of the existing theories of the surface tension of binary mixtures. The surface tension isotherms were calculated according to the Zhukhovitskiĭ formulas. Considerable divergence between experiment and the calculations was noted, and the possible reasons for the divergence were indicated. It was shown that the surface tension isotherms of the alloys in vacuum and at the electrolyte interface (at the electrocapillary curve maxima) are identical, showing the existence of approximately the same composition of surface layers of the alloys at both sides of the interface. (auth)

20254

X-RAY ANALYSIS OF SOME LIQUID METALLIC SYSTEMS. A. S. Lashko (Inst. of Metallophysics, Academy of Sciences, U.S.S.R.). Zhur. Fiz. Khim. 33, 1730-8 (1959) Aug. (In Russian)

Formulas were derived for calculating the atomic

distribution functions of binary liquid systems from x-ray data. By employing the method of integral analysis of the intensity curves, the atomic distribution functions were determined for the liquid alloys tin–bismuth, tin–zinc, aluminum–silver, and gold–tin. Analysis of the atomic distribution curves for liquid alloys of eutectic composition shows the existence of small areas where the near order statistics are the same as for the pure components. This "quasi-eutectic" structure is present not only near the crystallization point but also above it. Analysis of the atomic distribution curves for the liquid gold–tin alloy (50%) calculated from x-ray data shows that at temperatures near the crystallization point the near order statistics correspond to distribution of atoms in the solid state. However, besides this distribution, which is predominant, regions are revealed in the liquid alloy with the A and B statistical distribution. In the aluminum–silver alloy (13.7 at. % Ag) two types of packing may be assumed to exist in the liquid state, distribution corresponding to near order statistics in the γ phase and distribution similar to atomic distribution in liquid aluminum. (auth)

20255

ANODIC BEHAVIOR OF ALUMINUM IN AN ELECTROPOLISHING ELECTROLYTE AT SMALL POLARIZING CURRENT DENSITIES. G. S. Vozdvizhenskiĭ, V. A. Dmitriev, and O. A. Avdeeva (Kazan Branch, Academy of Sciences, S.S.S.R.). Zhur. Fiz. Khim. 33, 1788-90 (1959) Aug. (In Russian)

The low current density anodic dissolution of aluminum in an electrolyte containing an oxidant takes place with high current efficiency (162%). A disperse deposit consisting of aluminum and its hydroxide is formed on the anodic surface. The high anodic efficiency of aluminum is associated with its partial transition into solution in the form of univalent ions, part of which immediately disproportionates to form the metal and trivalent ion, and part is oxidized in the vicinity of the anode by hexavalent chromium. (auth)

20256

HEAT CONTENT AND HEAT CAPACITIES IN THE SYSTEM TITANIUM–SILICON. Yu. M. Golutvin (Baikov Inst. of Metallurgy, Academy of Sciences, S.S.S.R.). Zhur. Fiz. Khim. 33, 1798-1805(1959) Aug. (In Russian)

The heat content of the silicides $TiSi_2$, TiSi, and Ti_5Si_3 and of metallic titanium were determined in a massive calorimeter by the mixing method. After differentiating the heat content equations, expressions were obtained for the heat capacities as a function of the temperature: $TiSi_2: C_p = 14.94 + 8.32 \times 10^{-3} T - 0.455 \times 10^{6} T^{-2}$ cal/(deg.mole); (298 to 1180°K, ± 1.9%); $TiSi: C_p = 15.43 - 0.8832 \times 10^{6} T^{-2}$ cal/(deg.mole); (298 to 1350°K, ± 1.8%); $Ti_5Si_3: C_p = 58.22 \pm 5.742 \times 10^{-3} T - 2.646 \times 10^{6} T^{-2}$ cal/(deg.mole); (298 to 1170°K, ± 3.0%); α-Ti: $C_p = 8.641 + 1.405 \times 10^{-4} T - 0.3467 \times 10^{6} T^{-2}$ cal/(deg.g.atom); (298 to 1155°K, ± 1.6%); and β-Ti: $C_p = 7.968$ cal/deg.g.atom; (1155 to 1400°K, ± 0.8%). The heat of the transition α-Ti $\rightarrow$ β-Ti was found to be: $\Delta H_{1155} = +820 \pm 20$ (± 2.4%) cal/g.atom. Using the data of the present work and the values for the heats of formation of silicides previously measured, the temperature dependences of the heat effects were calculated. (auth)

20257

X-RAY ANALYSIS OF THE CRYSTAL STRUCTURE OF Ti_5Ge_3 AND Ti_5Si_3. N. V. Ageev and V. P. Samsonov (Baikov Inst. of Metallurgy, Academy of Sciences, U.S.S.R.). Zhur. Neorg. Khim. 4, 1590-5(1959) July. (In Russian)

Crystalline structures formed from 99.7% pure iodide titanium, 99.7% pure silicon, and 99.9% pure germanium were investigated. (R.V.J.)

20258

STUDIES OF SILVER–RUTHENIUM ALLOYS. A. A. Rudnitskiĭ and O. A. Novikova. Zhur. Neorg. Khim. 4, 1596-1600(1959) July. (In Russian)

The constitution diagram developed for silver–ruthenium alloys exhibits a limited solubility in both liquid and solid states. Alloys with 0.5, 1, 2, 3, 5, 8, 12, and 15% Ru crystallized with eutectic transformation taking place at 920°C with 3% Ru. Ruthenium does not diffuse into solid silver. Admixtures of up to 3% Ru do not change the thermoelectric forces in silver, do not improve the electric properties or the resistance to deformation, but do reduce the plasticity. The alloys composed of < 3% Ru crystallize into a binary alloy with a unique structure which determines its properties. (R.V.J.)

20259

INVESTIGATION OF GOLD–RUTHENIUM ALLOYS. A. A. Rudnitskiĭ and O. A. Novikova. Zhur. Neorg. Khim. 4, 1601-5(1959) July. (In Russian)

Studies were made of the phase diagram and physical properties of gold–ruthenium alloys with 0.5, 1, 2, and 3% Ru. Alloys with 1% Ru recrystallize with a peritectic reaction. The ruthenium-rich β phase interacts to form a gold-base α solid solution. Ruthenium diffusion in gold does not exceed 1%, diminishing at lower temperatures. Admixtures of less than 1% Ru change the thermoelectric and electric properties of gold by reducing the temperature coefficient of electric resistance. The addition of 0.5% Ru affects plasticity and rupture strength without changing hardness. (R.V.J.)

20260

TRANSFORMATIONS IN SOLID IRON–COBALT–PALLADIUM ALLOYS. V. V. Kuprina and A. T. Grigor'ev. Zhur. Neorg. Khim. 4, 1606-12(1959) July. (In Russian)

Differential thermal analyses and microstructure studies were made of polythermal cross sections in iron–cobalt–palladium alloys. It was found that alloys with 2, 5, 10, 20, 30, and 50 at.% Pd are subject to polymorphous transformation. The transformation is followed by a wide double-phase region ($\alpha + \gamma$) which contracts with increases of palladium content and temperature. A triple phase region ($\alpha + \gamma + \gamma$) forms with alloys rich in iron. (R.V.J.)

20261

PHASE ANALYSIS OF THE COPPER ANGLE IN THE Cu–Ni–Si SYSTEM. N. F. Lashko and K. P. Sorokina. Zhur. Neorg. Khim. 4, 1613-15(1959) July. (In Russian)

A method was developed for the electrolytic separation of phases in Cu–Ni–Si systems. In alloys with 1.5% Si and 3, 7, 12, and 20% Ni, three phases were found, δ-Ni_2Si, Ni_5Si_2, and Ni_3Si, without copper and in equilibrium with the corresponding copper-base solutions. Solid solutions of alloys with 7% Ni are in equilibrium with the δ-Ni_2Si phase. At 500 to 700°C alloys with 12% Ni are in equilibrium with the Ni_5Si_2 phase, while with 20 to 25% Ni and 1.5 to 5% Si the Ni_5Si_2 and Ni_3Si phases are in equilibrium with the solid solution. (R.V.J.)

20262
INTERACTIONS OF ALUMINUM AND NIOBIUM. V. M. Glazov, V. N. Vigdorovich, and G. A. Korol'kov (Kalinin Moscow Inst. of Non-Ferrous Metals and Gold). Zhur. Neorg. Khim. 4, 1620-4(1959) July. (In Russian)

Interactions of aluminum with niobium in the liquid and solid states were analyzed. (R.V.J.)

20263
TRANSFORMATIONS OF THE ZIRCONIUM ANGLE IN Zr-Sn-Mo ALLOYS DURING ANNEALING AND TEMPERING. O. S. Ivanov and A. T. Semenchenkov. Zhur. Neorg. Khim. 4, 1625-9(1959) July. (In Russian)

An x-ray analysis of zirconium-molybdenum-tin alloys annealed at 900°C revealed that the amount of Mo affects the β-phase transformation into an α' phase with an α-zirconium lattice or into the ω-phase with a hexagonal lattice. The greatest hardness is achieved during the transition from the β-phase into the ω-phase. The α' phase, saturated with molybdenum and tin, disintegrates at 250 to 450°C according to the annealing scheme. The greatest hardness, H = 350 $kg/_{mm}2$, is achieved with 400°C tempering. At 500°C the hardness is lowered to 250 $kg/_{mm}2$. Alloys in $\beta + \omega$ phases after annealing increase their hardness from 330 to 450 $kg/_{mm}2$ with an increase in annealing temperature from 150 to 300°C. (R.V.J.)

20264
THE CONSTITUTION DIAGRAM OF Ti-V-Nb ALLOY. I. I. Kornilov and V. S. Vlasov. Zhur. Neorg. Khim. 4, 1630-7(1959) July. (In Russian)

The constitution diagram and phase transformations of titanium-vanadium-niobium solid solutions were investigated. The β, α, and $\alpha + \beta$ phase regions and their boundaries were found. The β solid solution becomes continuous at >885°C, while below this temperature a limited solid solution is formed with a titanium α base modification. An $\alpha + \beta$ region appears between the α and β solid solutions. (R.V.J.)

20265
PROCEEDINGS OF THE SECOND UNITED NATIONS INTERNATIONAL CONFERENCE ON THE PEACEFUL USES OF ATOMIC ENERGY, HELD IN GENEVA, 1 SEPTEMBER-13 SEPTEMBER 1958. VOLUME 5. PROPERTIES OF REACTOR MATERIALS. Geneva, United Nations, 1958. 635p. $14.00.

Materials for the fabrication of reactor fuel elements and structural parts exposed to intense radiation are discussed in this volume. The mechanical properties and corrosion resistance of alloys, oxides, and sintered products at high temperatures and in the coolant environments of power reactors were investigated. A few papers on neutron absorbers are also included. The effects of radiation on both structural and fuel materials, especially under power reactor conditions, were investigated. (W.L.H.)

20266
NON-DESTRUCTIVE CLAD THICKNESS MEASUREMENT ON URANIUM OXIDE FUEL PINS. Presented at Nuclear Engineering and Science Conference, April 6-9, 1959, Public Auditorium, Cleveland, Ohio. Preprint V-86. Russell M. Ball (Babcock & Wilcox Co., Lynchburg, Va.). New York, Engineers Joint Council, 1959. 5p. $0.50.

A technique has been developed for measuring thickness of the stainless steel cladding on 0.500 inch OD fuel pins containing slightly enriched uranium oxide. The accuracy is ±0.5 mils in the range from 25 mils to 45 mils. Correlations have been made with destructively tested pins and with hollow wall tubings. The method uses a "sheet" of D.C. current fed from a source whose output impedance is high compared with the total clad resistance. Voltages are then measured across small spans with a null potentiometer. (auth)

20267
RATE OF ALLOYING OF METAL FUELS WITH STAINLESS STEEL ABOVE 1500°F. Presented at Nuclear Engineering and Science Conference, April 6-9, 1959, Public Auditorium, Cleveland, Ohio. Preprint V-89. Richard S. Neymark (Atomics International, Canoga Park, Calif.). New York, Engineers Joint Council, 1959. 19p. $0.50.

The rate of alloying between 304 stainless steel and uranium-base or thorium-base metal fuels was determined between 1600 and 2300°F. Within this temperature range, the iron-uranium eutectic forms more rapidly than the iron-thorium eutectic. (auth)

20268
SEGREGATION IN ALUMINUM-13% URANIUM CASTINGS. Presented at Nuclear Engineering and Science Conference, April 6-9, 1959, Public Auditorium, Cleveland, Ohio. Preprint V-105. D. Peckner (Westinghouse Electric Corp., East Pittsburgh, Penna.). New York, Engineers Joint Council, 1959. 10p. $0.50.

The possible existence of long range uranium segregation in aluminum-13% uranium castings was investigated. Chemical analysis indicated that castings were relatively homogeneous on a macroscopic scale. An anomalous phase, UAl_3, was observed in the castings which can be accounted for on the basis of solidification theory. (auth)

20269
THE EFFECT OF METALLIC IMPURITIES ON THE PROPERTIES OF URANIUM AND 2 W/O MOLYBDENUM-URANIUM ALLOYS. Presented at Nuclear Engineering and Science Conference, April 6-9, 1959, Public Auditorium, Cleveland, Ohio. Preprint V-107. James M. Dickinson and Eugene G. Zukas (Los Alamos Scientific Lab., N. Mex.). New York, Engineers Joint Council, 1959. 13p. $0.50.

The amount of common metallic impurities that can be tolerated in uranium or in 2 wt.% molybdenum-uranium alloys without forming a network of second phase, which weakens the metal, has been determined. A relationship between impact strength and grain boundary networks is presented. (auth)

20270
SINTERABILITY OF UO_2 POWDERS FOR FUEL ELEMENTS. Presented at Nuclear Engineering and Science Conference, April 6-9, 1959, Public Auditorium, Cleveland, Ohio. Preprint V-108. R. Bruce Wrinkle (Mallinckrodt Chemical Works, St. Charles, Mo.). New York, Engineers Joint Council, 1959. 14p. $0.50.

Micronized UO_2 has exhibited the highest sintered density of any powder compact tested after extrusion or after cold pressing. Particle size and surface area of ground UO_2 powders show some correlation with sintered density. Dimensional variations in extruded rods were definitely larger than in pressed compacts. (auth)

20271
A DIFFUSION MECHANISM OF THE INITIAL SINTERING OF REFRACTORY MATERIALS. Presented at Nuclear Engineering and Science Conference, April 6-9, 1959, Public Auditorium, Cleveland, Ohio. Preprint

V–109. R. Chang (Atomics International, Canoga Park, Calif.). New York, Engineers Joint Council, 1959. 11p. $0.50.

The effect of doping and environment on sintering of refractory materials is discussed. It is concluded that a diffusion mechanism predominates in the initial sintering of refractory oxides. At high sintering temperatures, the volume diffusion mechanism predominates, while grain-boundary or surface diffusion may be important at lower sintering temperatures. (auth)

20272

FORGE ROLLING ZIRCALOY COMPONENTS. Presented at Nuclear Engineering and Science Conference, April 6-9, 1959, Public Auditorium, Cleveland, Ohio. Preprint V–110. R. D. Johnson, R. J. Gridley, and R. L. Clark (Clevite Research Center, Cleveland). New York, Engineers Joint Council, 1959. 27p. $0.50.

A forge-rolling process was developed to produce recessed Zircaloy cover plates. Initial work on a single-pass system led to the development of a two-pass system with which two specific shapes were effected. A multipart roll was designed and employed in forge rolling the second shape. (auth)

20273

IRRADIATION-INDUCED HYDROGEN ABSORPTION BY NICKEL-ENRICHED ZIRCALOY-2. Presented at Nuclear Engineering and Science Conference, April 6-9, 1959, Public Auditorium, Cleveland, Ohio. Preprint V–111. William Yeniscavich, Richard A. Wolfe, and Richard M. Lieberman (Westinghouse Electric Corp., Pittsburgh). New York, Engineers Joint Council, 1959. 21p. $0.50.

Specimens of ordinary and nickel-enriched Zircaloy-2 were subjected to autoclave corrosion and irradiation in a hot water loop. When exposed only to the corrosion media, the nickel-enriched samples absorbed about 10 times more hydrogen than the ordinary Zircaloy-2. In the presence of both corrosion and irradiation the nickel-enriched material absorbed about 100 times more hydrogen than did ordinary Zircaloy-2. (auth)

20274

THE USE OF ULTRASONICS IN THE TESTING OF IRRADIATED FUEL ELEMENTS. Presented at Nuclear Engineering and Science Conference, April 6-9, 1959, Public Auditorium, Cleveland, Ohio. Preprint V–112. John M. Fouts (General Electric Co., Richland, Wash.). New York, Engineers Joint Council, 1959. 6p. $0.50.

The application of ultrasonic techniques in nondestructively locating and identifying unbonded areas between the uranium core and aluminum can of Hanford irradiated fuel elements is presented. Details of the underwater equipment and the electronic components are described in addition to the results of testing. (auth)

20275

SODIUM CORROSION AS A FUNCTION OF TIME. Presented at Nuclear Engineering and Science Conference, April 6-9, 1959, Public Auditorium, Cleveland, Ohio. Preprint V–114. John M. McKee (Nuclear Development Corp. of America, White Plains, N. Y.). New York, Engineers Joint Council, 1959. 20p. $0.50.

Periodic weight loss measurements were made on tabs suspended in duplicate stainless steel thermal convection loops circulating sodium between 1575 and 1100°F for 5000 hours. Considerable decay in corrosion rate was observed due to the formation of a protective ferritic layer on the tab surfaces. (auth)

20276

TVERDOST' STALEY I TVERDYKH SPLAVOV PRI POVYSHENNYKH TEMPERATURAKH. (Hardness of Steel and Hard Alloys at High Temperatures). Archil Iosifovich Betaneli. Moscow, Mashgiz, 1958. 94p.

Results of experiments dealing with the relationship between the temperature and hardness of structural steel, tool steel, high speed steels, and carbides are presented. In the study of the composition effect on the relationship between resistance to deformation and the rate of deformation at specified temperatures, the hardness values of metal measured at varying initial rates of point penetration may be used. In the course of these experiments a relationship was established between hardness, ultimate strength, and other mechanical properties of metals at elevated temperatures. Experiments show that the method of testing for long-time hardness of metals and alloys does not fully replace tests for fatigue strength and creep. However, they provide valuable data for studying the composition, microstructure, and other properties of metals and alloys. The text contains graphs showing the interdependence of hardness and temperature of various metals and alloys. (auth)

20277

PLAVLENYYE LITYYE OGNEUPORY. (Cast Fused Refractories.) Adol'f Abramovich Litvakovskii. Moscow, Gosstroyizdat, 1959. 308p.

A historical review of the development of aluminum–silicon refractory production is presented. High melting metal oxides in the Al_2O_3–SiO_2–ZrO_2 system and the effects of corrosion on refractory materials are discussed. Methods of controlling the size of refractory crystals, an investigation to establish the optimum composition ratio for the Al_2O_3–SiO_2–ZrO_2 system, and the basic method of producing cast fused refractories are also discussed. (TCO)

20278

ANODIC TREATMENT OF URANIUM METAL. R. A. U. Huddle and O. Flint (to UK Atomic Energy Authority). British Patent 803,990. Nuclear Eng. 4, 324(1959) July-Aug.-Sept.

A method is proposed for the cleaning of tarnished surfaces of uranium components, such as rods, for instance, by anodic treatment resulting in a bright surface which is retained, on exposure to air, for periods of up to 12 months. The rods are made anodic in concentrated sulfuric acid (1.84 s.g.), to which 5% by weight of chromium trioxide may be added. The cathode should be of lead and separated from the anolyte by a porous diaphragm. A potential of 12 v should be applied. In the course of the treatment the initial current decreases, apparently due to the formation of a thin oxide film which imparts a passive condition to the surface.

20279

URANIUM ALLOYS USEFUL FOR THE RELEASE OF ATOMIC ENERGY. (to UK Atomic Energy Authority (Canada)). British Patent 805,782. Nuclear Eng. 4, 324(1959) July-Aug.-Sept.

A binary uranium–silicon alloy containing 0.5 to 10% (preferably between 1 and 8%) of silicon is reported. Silicon reduces the tendency of uranium to corrode at high temperature and has a small neutron capture cross section.

PARTICLE ACCELERATORS AND HIGH-VOLTAGE MACHINES

20280 CERN-59-26
European Organization for Nuclear Research, Geneva.
LE SYNCHROTRON A PROTONS DU CERN. (2ème PARTIE). Ch. V. L'INJECTION DES PARTICULES. (The Proton Synchrotron at CERN. Part 2. Chapter V. The Injection of Particles.) E. Regenstreif. July 31, 1959. 203p.

The injection system in the CERN proton synchrotron is based on the use of a linear accelerator of the Alvarez type. The general arrangement of the injection system is first discussed, and it is then described in detail. The principles of the proton linear accelerator with the Alvarez structure are reviewed. The selection of the parameters of the linear accelerator, the ion source, the 500-kev pre-accelerator, beam focalization between the source and the linear accelerator, the collector, and the deflectors and dampers are described as an introduction to the accelerator itself. The h-f power feed of the cavities, the control of the accelerator field in the cavities, focalization in the linear accelerator, phase adjustment of the accelerating cavities, adaptation of the beam to the synchrotron, the degrouper, deflection optics, and auxiliary apparatus between the linear accelerator and the synchrotron are considered. (J.S.R.)

20281 DESY-A1.6
Deutsches Elektronen-Synchrotron, Hamburg.
DESCRIPTION OF THE ACCELERATOR (DESY). K. G. Steffen. July 15, 1959. 63p.

A 6-Bev alternating gradient electron synchrotron, similar to the Cambridge Electron Synchrotron, is being constructed at Hamburg. The basic design features of the accelerator and its buildings are summarized. The maximum energy and orbit radius, AG magnet structure, magnet power cycle, radiation by electrons, radiofrequency acceleration, injection, cross section of vacuum chamber and useful magnetic field, magnets and coils, orbit correction devices, beam observation, vacuum system, foundation of magnet ring and magnet alignment, buildings, and external beams are discussed. (J.S.R.)

20282 DESY-A2.23
Deutsches Elektronen-Synchrotron, Hamburg.
FESTLEGUNG DES MITTLEREN RADIUS UND DER DAMIT VERBUNDENEN GRUNDPARAMETER FÜR DESY. (Establishment of the Average Radius and the Basic Parameter Connected with it for Desy.) May 6, 1958. 3p.

The mean radius of the ideal orbit in the Hamburg Electron Synchrotron was established on the basis of the frequency of the linac, either 2848 or 2998 MHz. The mean radius, 49.25 or 49.46 m, respectively, and associated parameters are tabulated. (J.S.R.)

20283 DESY-A2.24
Deutsches Elektronen-Synchrotron, Hamburg.
AUSWIRKUNG VON AMPLITUDEN- UND PHASEN-FEHLERN DER CAVITIES AUF DIE HF-LEISTUNG. (Effect of the Amplitude and Phase Errors of the Cavities on the HF Power.) May 8, 1958. 1p.

The effects of the amplitude and phase errors of the cavities on the h-f power requirements are discussed. The additional power needs caused by the amplitude error are estimated to be 10% of the normal cavity loss when the mean plus-minus error of the single amplitude is 30%. The increase of cavity loss for phase error is calculated. The cavity loss at the end of the acceleration is approximately 50% of the total power, and a power reserve of 10% for the amplitude and phase errors is proposed. (J.S.R.)

20284 DESY-A2.26
Deutsches Elektronen-Synchrotron, Hamburg.
STRAHLUNGSEFFEKTE IM ELEKTRONEN-SYNCHROTRON. (Radiation Effects in the Electron Synchrotron.) May 31, 1958. 15p.

The electromagnetic radiation emitted in electron synchrotrons by the rotating electron and the effect of this energy loss on the particle orbit is considered. Equations are derived which describe the energy loss from radiation, the radiation reaction on electron motion, classical approximation of radiation reaction on betatron oscillations, and the quantum effect. The Matveev treatment of radiation reaction is briefly considered. The equations derived are evaluated for DESY, and the numerical results are graphed. (J.S.R.)

20285 DESY-A2.28
Deutsches Elektronen-Synchrotron, Hamburg.
AUSLEGUNG DER RINGDROSSEL UND DER SPERR-KREISE. (Interpretation of the Ring Choke and Block Circuit.) July 29, 1958. 18p.

The dimensions and specifications of a ring choke using cold-rolled preferentially oriented iron are derived. The iron and copper loss is calculated. The cost of the block circuit is estimated, and the optimum choke is sketched. (J.S.R.)

20286 DESY-A2.30
Deutsches Elektronen-Synchrotron, Hamburg.
VERWENDUNG VON GESÄTTIGTEN DROSSELSPULEN IM MAGNETSTROMKREIS. (Application of Saturated Choke Soils in the Magnet Circuit.) Aug. 12, 1958. 9p.

For the control of the magnetic current saturated choke coils are proposed. The parameters and dimensions of the choke coil, made from cold-rolled sheet iron M6-W, are discussed. The behavior of the magnet current supply at various modulations is determined. (J.S.R.)

20287 DESY-A2.36
Deutsches Elektronen-Synchrotron, Hamburg.
ÜBER DIE AUSWIRKUNG VON STREUPROZESSEN AN RESTGASATOMEN AUF DEN QUERSCHNITT DES ELEKTRONENSTRAHLS EINES SYNCHROTRONS. (The Results of Scattering Processes on Residual Gas Atoms on the Cross Section of the Electron Beam of a Synchrotron.) Oct. 17, 1958. 22p.

An electron circulating in a synchrotron can be excited to oscillations from the ideal orbit or deflected from the chamber by collisions with a residual gas atom. The frequency of this process (during the acceleration) and its effect on the final intensity and the cross section of the electron beam are investigated. Equations are derived and numerically evaluated for the particle loss of the synchrotrons at Bonn, Cornell, and CEA and for two variations of DESY. (J.S.R.)

20288 DESY-A2.47
[Deutsches Elektronen-Synchrotron, Hamburg].
AUSLEGUNG UND KONSTRUKTION VON QUADRUPOL-TRIPELN FUR DIE INJEKTION. (Design and Construction of Quadrupole Triplets for the Injection.) U. Timm and H. Schneemann. June 23, 1959. 19p.

The quadrupole triplets used for beam control in the Hamburg Electron Synchrotron are analyzed. The region

which is necessary for the total focal length is established. The relationship existing between the focal distance of the single lens of the triplets and the total focal distance is determined. The construction of the lens is also discussed. (tr-auth)

20289 DESY-A2.48
Deutsches Elektronen-Synchrotron, Hamburg.
BEMERKUNGEN ZUR LAGERUNG DES RINGES. (Remarks on the Support of the Rings.) O. Beer. July 31, 1959. 3p.

Three possibilities for the support of the ring magnets are described. The possibilities are the suspension of the ring magnet as is done in the CERN synchrotron, pendulum support for the ring, and connection of the ring to a hydraulic press which is fastened to a column that, in turn, is solidly fixed on the ring foundation. (J.S.R.)

20290 INSJ-17
Tokyo Univ. Inst. for Nuclear Study.
STATUS REPORT OF 1 GEV ELECTRON SYNCHROTRON. July 1, 1959. 7p. (TH-33).

A table of parameters for the 0.75-Bev electron synchrotron is given. The general arrangement and the cross section of the magnets and a block diagram of the linac injector are shown. The accelerating cavity and the vacuum chamber are briefly mentioned. (W.D.M.)

20291 INSJ-18
Tokyo Univ. Inst. for Nuclear Study.
STATUS REPORT OF 6 MEV LINEAR ELECTRON ACCELERATOR. T. Nishikawa, A. Miyahara, and J. Tanaka. July 1, 1959. 7p. (TH-34).

The 6-Mev linear accelerator is to be used for the injector of the 1-Bev electron synchrotron so it is required to have a good energy spectrum and high beam current. A peak beam current of 100 to 200 ma will be obtained in a 5% energy spread having a pulse width of 2 μsec. A block diagram of the linac is given. (W.D.M.)

20292 NP-7818
[Deutsches Elektronen-Synchrotron, Hamburg].
VERGLEICH EINIGER KRITISCHER PARAMETER FÜR DIE MASCHINEN CERN, CEA UND DESY. (Comparison of Some Critical Parameters for the CERN, CEA, and DESY Machines.) Dec. 5, 1957. 4p.

The critical parameters of the CEA, CERN, and DESY synchrotrons are tabulated and compared. The values for DESY are preliminary and those for CEA and CERN are from the most recent reports. (J.S.R.)

20293 NP-7819
[Deutsches Elektronen-Synchrotron, Hamburg].
BERICHT ÜBER DIE IN GENF ANGESTELLTEN ÜBERLEGUNGEN ZUR WAHL DER PARAMETER. (Report on the Considerations Made in Geneva on the Value of the Parameters.) Dec. 8, 1957. 7p.

The effects of synchrotron bremsstrahlung on the betatron and synchrotron oscillations were considered. The amplitude of the betatron oscillations and the radiation loss occurring at 6 and 7.5 Bev were determined at various rotation frequencies and magnetic fields. It was proposed that the oscillations be controlled by a favorable choice of synchrotron parameters and not by correction elements. (J.S.R.)

20294 NP-7820
[Deutsches Elektronen-Synchrotron, Hamburg].
VORLÄUFIG GESCHÄTZTE BAUKOSTEN DER HF FÜR 6 GeV (IN 1000 DM). (Preliminary Estimated Building Costs of the HF for 6 Bev. (In 1000 DM).) Jan. 29, 1958. 2p.

A preliminary estimate of the construction and operating costs of the high-frequency system for the Hamburg Electron Synchrotron is presented and compared with the construction costs for the CEA proton synchrotron. The synchrotron parameters on which the estimate is based are tabulated. (J.S.R.)

20295 NP-7821
[Deutsches Elektronen-Synchrotron, Hamburg].
BEMERKUNGEN ZUR VAKUUMKAMMER. (Remarks on the Vacuum Chamber.) O. Beer. Feb. 7, 1958. 5p.

To improve the eddy current of the vacuum chamber, it is necessary that the chamber be constructed of laminated metal or of an insulating material. As there is no simple solution to the production difficulties of manufacturing laminated metal, the application of porcelain to the chamber construction is considered. The production, possible radiation damage, and chamber fabrication are discussed. As the radiation damage is too severe, a compromise solution using both laminated metal and porcelain is proposed. (J.S.R.)

20296 NP-7822
[Deutsches Elektronen-Synchrotron, Hamburg].
HAARNADEL–LINEARBESCHLEUNIGER. (Hairpin Linear Accelerator.) Dec. 5, 1957. 4p.

A linear accelerator, in which the length of the accelerator is cut in half by a 180° rotation of the beam, is considered. The beam and phase broadening which would occur is calculated. It is shown that the realization of a hairpin linear accelerator depends, essentially, on the acceptable energy scattering at the end of the acceleration. (J.S.R.)

20297 UCRL-5311
California. Univ., Livermore. Radiation Lab.
SCATTERBRAIN—AN AUTOMATED EXPERIMENT ON THE 90-INCH CYCLOTRON. J. Benveniste, E. A. Lafranchi, G. E. Strahl, and R. L. Swenson. Oct. 1958. 18p. Contract W-7405-eng-48. $4.80(ph), $2.70(mf) OTS.

By controlling certain elements within a vacuum chamber from an external station, a charged particle experiment is performed without opening the chamber, thereby saving considerable time and labor. By preprogramming the experimental sequence on the external controls, the experiment can be performed from beginning to end with a minimum of operator attention. The data collected can be read out automatically on a punched paper tape for subsequent transmission to a digital computer. (auth)

20298 UCRL-5848
California. Univ., Livermore. Lawrence Radiation Lab.
AIR-CORE STRONG FOCUSING SYNCHROTRON. Nicholas C. Christofilos. Aug. 21, 1959. 19p. Contract W-7405-eng-48. $3.30(ph), $2.40(mf) OTS.

An air-core strong focusing synchrotron is described. Low-temperature magnets 80°K or lower are proposed. High magnetic field value and high acceleration rate are characteristic advantages of the air-core magnets. The machine becomes smaller while the required radiofrequency power is considerably increased. Present accelerators can be classified in either of two extremes: closed orbit accelerators where one can hardly see the accelerating element and the main component is the guiding magnet and the acceleration time

is of the order of a second; linear accelerators where the particles travel once through the machine and, due to this fact, tremendous amounts of rf power are required. The proposed machine is a compromise between these extremes; hence, the cost of the magnet and accelerating equipment is well balanced; the acceleration is of the order of a few tens of milliseconds. Molecular beam injection is proposed, allowing multi-turn injection; thus trapping of 6×10^{12} particles per pulse is possible. By employing high magnetic fields it is possible to reduce the aperture; hence, the final beam cross-sectional area becomes very small, allowing synchro-clash operation of two machines without the necessity of storage, with satisfactory reaction yield. The magnet units are combined with the radiofrequency cavities. This arrangement eliminates long straight sections except at the injection and targets. Parameters of a 24-Bev machine of this type are cited. A method of avoiding blow-up of the beam at the phase transition is described. By properly changing the amplitude of the rf voltage near the phase transition energy, it is possible to obtain solutions of constant amplitude for both the momentum and phase oscillations. (auth)

20299 UCRL-8808

California. Univ., Berkeley. Lawrence Radiation Lab. ELECTROSTATIC TRACKING OF THE PROTON BEAM OF THE BEVATRON. Harry G. Heard. June 11, 1959. 17p. Contract W-7405-eng-48. $0.75(OTS).

The use of p-n junction voltage-sensitive capacitors to modify the basic radio-frequency tracking program of the Bevatron is described. It is shown that adequate dynamic range exists to position the proton beam anywhere within the useful aperture of the accelerator at any energy during the acceleration or deceleration cycle. The advantages of electrostatic as contrasted with the former magnetic-tracking correction are discussed. A completely transistorized relay-operated function generator is described that synthesizes the tracking-error-correction signal during the acceleration and deceleration cycles. (auth)

20300

A 120 cm CYCLOTRON. A. G. Alekseev, M. A. Gashev, D. L. Dondysh, I. F. Malyshev, I. M. Matora, E. S. Mironov, N. A. Monoszon, L. M. Nemenov, V. V. Pirogovskiĭ, N. S. Streltsov, and N. D. Fedorov. Atomnaya Energ. 7, 148-58(1959) Aug. (In Russian)

A 120-cm cyclotron is described, and data are given on the design of the installation, construction of various points, high-frequency equipment, and methods for measuring and correcting the magnetic field. The nature of the beam deflecting system and focusing on remote targets is analyzed. Deuterons are accelerated up to 13.7 Mev. Small aperture magnetic quadrupole lenses were used in the deflecting and focusing systems, giving practically complete beam delivery to remote targets. (R.V.J.)

20301

COHERENT ELECTRON RADIATION IN A SYNCHROTRON. II. L. V. Iogansen and M. S. Rabinovich (Lebedev Inst. of Physics, Academy of Sciences, S.S.S.R. and Lenin Moscow State Pedagogical Inst.). Zhur. Eksptl'. i Teoret. Fiz. 37, 118-24(1959) July. (In Russian)

The electromagnetic interaction of electrons in a thin relativistic bunch during coherent radiation in a synchrotron is considered. The magnitude of tangential forces acting on an individual electron by the bunch is computed under various assumptions regarding the phase distribution of the particles. (auth)

20302

EFFECTS OF INTERACTIONS ON ELECTRON PHASE MOTION IN SYNCHROTRON. L. V. Iogansen (Moscow State Teacher's Inst.). Zhur. Eksptl'. i Teoret. Fiz. 37, 299-300(1959) July. (In Russian)

The effects of electromagnetic electron interaction forces in the cluster on the phase motion of electrons were approximated, and the angular dimensions of the cluster, determined by the interacting forces, were estimated. The screening of electron interactions with the chamber walls and magnets were not considered; thus the estimate fits only small clusters. (R.V.J.)

PHYSICS AND MATHEMATICS

General

20303 58-GL-213

General Electric Co. General Engineering Lab., Schenectady, N. Y.

STATISTICAL TOLERANCE REGIONS. J. H. Stapleton. July 15, 1958. 28p.

A review, supplemented by a rather extensive bibliography, is made of the development of the theory of statistical tolerance regions. An original method for establishing approximate tolerance regions for the Weibull distribution is presented. A method for establishing two-sided tolerance limits for multiple linear regression is given. (auth)

20304 A-393

Columbia Univ., New York. [Div.] of War Research. THE CONCENTRATION OF DEUTERIUM BY THE S-PROCESS. I. FUNDAMENTAL PRINCIPLES AND BASIC METHOD OF CALCULATION. Jerome S. Spevack. Dec. 3, 1942. Decl. Feb. 12, 1957. 65p. Project DSM. Contract OEMer-412. $10.80(ph), $3.90 (mf) OTS.

The two-temperature method for the concentration of isotopes readily lends itself to the concentration of deuterium. The system using the hydrogen sulfide–water exchange reaction has been selected as most practical. In this case water is the raw material and source of deuterium. Calculations show that the equilibrium constant for the deuterium exchange reaction between the two components favors concentration in the water. The constants calculated from spectroscopic data are given. Operation of the system is such that liquid water flows countercurrently to hydrogen sulfide gas. This action takes place in two towers and at two different temperatures. Water feeds into the cold tower. The concentration of deuterium in the hydrogen sulfide tends to approach equilibrium with the feed. This hydrogen sulfide then leaves the cold tower and enters the hot tower. Now the concentration of deuterium in the liquid tends to approach equilibrium with the gas from the cold tower. However, since the equilibrium constant is smaller at the higher temperature, the liquid leaving the hot tower can never reach the concentration of the feed liquor. The net result is a removal of deuterium from the feed. Calculations made on conditions within the towers are based on the effective fractionation factor. This factor is representative of equilibrium conditions and relates the distribution of the total quantity of deuterium in the liquid to the total quantity of deuterium

in the gas. This factor varies not only with the temperature but with the solubility of the hydrogen sulfide in the liquid and with the humidity of the water vapor in the gas. The operating pressure is determined by the cold tower temperature and is only limited by the vapor pressure of hydrogen sulfide. Operating the cold tower at a temperature below 30°C is unfavorable, due to the formation of $H_2S \cdot 6H_2O$ solid hydrate. The working temperature of the hot tower can be varied at will. The higher the temperature, the greater is the extraction efficiency. However, the humidity is also higher and as a result, the equipment is much larger. Optimum operating conditions can only be obtained after a careful economic study of all variables. It has been determined that there exists maximum and minimum flow limitations over a very small range. These are 2.13 and 1.45 moles of hydrogen sulfide recycling per mole of water feed equal to 1.8. (auth)

20305 AAEC/E-18

Australia. Atomic Energy Commission Research Establishment, Lucas Heights, New South Wales.
DISCHARGE COEFFICIENTS FOR THE NO. 1 SODIUM LOOP VENTURI METER. R. C. Cairns. Oct. 1957. 9p.

Discharge coefficients for the Venturi meter are reported for throat Reynolds numbers up to 298,000 using sodium. (auth)

20306 AECU-4251

Northwestern Univ., Evanston, Ill.
RADIATION EFFECT OF POSITIVE ION BOMBARDMENT. Progress Report [for] March 16, 1959 to June 15, 1959 and Annual Report [for] June 15, 1958 to June 15, 1959. R. L. Hines. July 1, 1959. 5p. Contract AT(11-1)-89, Project 15. $1.80(ph), $1.80(mf) OTS.

Data on ion bombardment of quartz are presented. The bombarding ions were Ar, Ne, He, H, deuterium, Kr, and Xe. Energies are given, and range and integrated flux information are included for Ar, Ne, and He. (J.R.D.)

20307 AECU-4281

Michigan State Univ., East Lansing.
ELASTIC MODULUS OF ISOTOPICALLY CONCENTRATED LITHIUM. W. M. Robertson and D. J. Montgomery. 1959. 17p. Contract AT(11-1)-400. $3.30(ph), $2.40(mf) OTS.

The elastic modulus of polycrystalline specimens of isotopically concentrated lithium was determined at 25°C by observing the resonant frequency of forced transverse vibration of extruded wires clamped at one end. The elastic modulus of lithium-6 (96.1% Li^6, 3.9% Li^7) was found to be $7.93 \pm 0.21 \times 10^{10}$ dynes/cm^2, and that of lithium-7 (7.5% Li^6, 92.5% Li^7) $7.98 \pm 0.33 \times 10^{10}$ dynes/cm^2. Within the limits of precision of the experiments, the values do not differ and are consistent with indirect estimates derived from data in the modern literature. (auth)

20308 AECU-4296

General Atomic Div., General Dynamics Corp., San Diego, Calif.
A FAMILY OF THERMALIZED CODES. D. H. Perkel. July 1, 1959. 73p. Project No. 11. Contracts AT(04-3)-167 and AT(04-3)-187. (GAMD-754(Rev.)) $12.30 (ph), $4.50(mf) OTS.

A series of computer codes for studying neutron thermalization in an infinite medium is described. The individual codes are described functionally, i.e., the kinds and numbers of input quantities, options, sequencing of cases, output, etc. Specifications of card input and output formats for each code are given as well as a list of available input data such as energy points, cross sections, and scattering kernels for various materials and temperatures. Some related codes are characterized briefly and useful tables are appended. (J.R.D.)

20309 AECU-4307

Illinois. Univ., Urbana. Digital Computer Lab.
TECHNICAL PROGRESS REPORT. PART I. HIGH-SPEED COMPUTER PROGRAM. PART II. MATHEMATICAL METHODS. PART III. ILLIAC USE AND OPERATION. PART IV. IBM 650 USE AND OPERATION. PART V. GENERAL LABORATORY INFORMATION. June 1959. 31p. Contracts AT(11-1)-415 and Nonr-1834(15). $6.30(ph), $3.00(mf) OTS.

The transient behavior of transistors at high injection rates was investigated, and basic experiments were conducted. Results are summarized. The design of an asymmetric flipflop with a reply signal was investigated. Experiments on disturbance effects on memory are described. Records of Illiac operation are given. (For preceding period see AECU-4307.) (D.E.B.)

20310 AERE-R-2882

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
A PROGRAMME FOR CALCULATING THE GAMMA RAY FLUX THROUGH A MULTILAYER SHIELD. D. E. Bendall. Mar. 1959. 34p. $0.70(BIS).

A program in autocode for the Ferranti Mercury Computer is described. It is designed to calculate the gamma ray flux due to a distributed source in a multilayered shield in plane geometry. Up to 43 different shield regions may be included and each of these may contain up to a maximum of 144 mesh intervals. Build up of low energy gamma photons is treated by means of an average build-up factor expressed in the Taylor form. The output may be chosen to be gamma dose rate or rate of energy deposition. (auth)

20311 AERE-R-2938

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
RADIOISOTOPE DATA. R. A. Allen, R. J. Millett, and D. B. Smith. May 1959. 164p. $1.12(BIS).

Data on generally available radioactive materials and associated short-lived isotopes are reported. Calculated yields after various times of irradiation are quoted. Half life, decay scheme, other isotopes produced, target material, production processes, and cross sections are given. Preliminary sections include information on health regulations, radioactive standards, and a table of K factors. (C.J.G.)

20312 AFOSR-TN-59-622

Pennsylvania State Univ., University Park. Field Emission Lab.
STUDY OF METAL SURFACES BY THE FIELD EMISSION MICROSCOPE. Technical Report No. 10 [on] A SEARCH FOR POLARIZATION OF FIELD-EMITTED ELECTRONS. Walter T. Pimbley. June 1959. 59p. Contract AF18(600)-672. (AD-217686).

Experiments were performed designed to detect polarization of field-emitted electrons using Mott scattering. Electrons emitted from various crystallographic planes of a clean tungsten surface, from individual

quarters of a phthalocyanine quadruplet on a clean tungsten substrate, and from single ferromagnetic domains of iron were analyzed in a temperature range from 21 to 900°K. In no case was any polarization detected. The average least detectable asymmetry factor that could be determined by the apparatus was calculated to be 0.04 corresponding to a polarization of 10% in a plane normal to the field emitted beam. (auth)

20313 ANL-6040
Argonne National Lab., Lemont, Ill.
BASIS AND DIMENSION IN ABSTRACT MODULE THEORY. Richard Chichester, Jr. Aug. 1959. 19p. Contract W-31-109-eng-38. $0.75(OTS).

A classical linear vector space is a unitary Δ-module, where Δ is a division ring. Properties of linear spaces are given. The approach used is a module theoretic one, that is, a sequence of progressively stronger impositions on the module structure of a unitary R-module M is studied, without regard to the nature of the operator ring R. (W.D.M.)

20314 CERN-59-28
European Organization for Nuclear Research, Geneva.
A COMPUTER PROGRAMME TO EVALUATE THE MEAN LIFE OF CHARGED PARTICLES FROM OSCILLOSCOPE TRACES. Y. Goldschmidt-Clermont and H. Paul. Aug. 11, 1959. 18p.

The present work was undertaken in order to obtain a more accurate value of mean life of the positive pion by measuring the time between incident pion and decay muon on a sample of 15,000 pions stopped in a scintillation counter whose pulses were fed to a travelling wave oscilloscope and photographed on continuously running film. The program described was written for the CERN Mercury computer to extract the information from the photograph scanning tapes. (W.D.M.)

20315 HE-150-151
California. Univ., Berkeley. Inst. of Engineering Research.
MATHEMATICAL FORMULATION OF THE ONE-DIMENSIONALIZED DYNAMICS OF A DIFFUSING BINARY GAS. V. Fillipenko. Dec. 5, 1957. 22p. Project No. 35. Contract AT(11-1)-34. $4.80(ph), $2.70(mf) OTS.

Equations describing the two-dimensional steady-state diffusion of a binary mixture of gases are presented. The motion of a binary gas mixture over a semi-infinite flat plate of zero incidence was studied. (W.L.H.)

20316 HR-59-474
Honeywell Research Center, Hopkins, Minn.
THE DUCTILE-BRITTLE TRANSITION IN IONIC SOLIDS. Technical Report No. 5. T. L. Johnston, R. J. Stokes, and C. H. Li. July 1959. 20p. Project No. Nonr-2456(00) NR 032-451.

Polished monocrystals of silver chloride, sodium chloride, lithium fluoride, and magnesium oxide exhibit ductility transitions when loaded by impact bending. The behavior of silver chloride stood apart from that of the other solids in that the temperature below which it cleaved without macroscopic deformation was less than 0.1 T_m (where T_m is the melting point in degrees Kelvin) whereas the corresponding temperatures for sodium chloride, lithium fluoride, and magnesium oxide were in the range 0.6 to 0.7 T_m. Notched monocrystals of silver chloride exhibited a change in fracture mode from cleavage to shear at a temperature of the order of 0.4 T_m. It is emphasized that the ductility of ionic solids is extremely sensitive to strain rate and the presence of a notch. (auth)

20317 IGIS-68(RD/CA)
United Kingdom Atomic Energy Authority. Industrial Group. Capenhurst Works, Capenhurst, Ches., England.
BIBLIOGRAPHY ON GAS TEMPERATURE MEASUREMENT. E. McCoy. June 10, 1959. 14p. $0.25(BIS).

This bibliography is compiled from references to books, articles, unclassified reports and patents taken from Chemical Abstracts, 1951 to 1956, Engineering Index, 1950 to 1957, Index Aeronautics, 1954 to 1957, Industrial Arts Index, 1954 to 1958, Nuclear Science Abstracts, 1948 to 1958, and Physics Abstracts, 1951 to 1958. (J.E.D.)

20318 KAPL-M-RAP-1
Knolls Atomic Power Lab., Schenectady, N. Y.
NILT — NUMERICAL INVERSION OF LAPLACE TRANSFORMS. C. Raymond Mullin and Robert A. Pfeiffer. Aug. 27, 1959. 16p. Contract W-31-109-Eng-52. $3.30(ph), $2.40(mf) OTS.

A code was developed to numerically invert Laplace transforms. A description of the technique is given, and comments on its accuracy, several examples, and a simple input are included. (auth)

20319 KAPL-M-RDH-1
Knolls Atomic Power Lab., Schenectady, N. Y.
CLOSED LOOP CODE FOR IBM-704. R. D. Howerton. July 9, 1959. 24p. Contract W-31-109-Eng-52. $4.80 (ph), $2.70(mf) OTS.

A FORTRAN code, CLP, for the simulation of the transient behavior of a closed loop reactor power plant system is described. The code has provision for the analysis of an arbitrary arrangement of reactor passes, pipes, plenums, leakages, and steam generators. There is provision for driving the system by control rod position, primary flow, steam generator, feedwater, flow, etc. The equations upon which the code is based and instructions for the preparation of input for operating the code are presented. (auth)

20320 LA-2295
Los Alamos Scientific Lab., N. Mex.
DURATION OF ATOMIC COLLISIONS. A NOTE ON RECOMBINATION RATE THEORY. Don L. Bunker. Nov. 28, 1958. 23p. Contract W-7405-eng-36. $4.80 (ph), $2.70(mf) OTS.

A mechanical treatment of atomic recombination reactions is developed for the case in which the reaction is considered to involve an intermediate excited molecule which is stabilized on collision with any third body. An explicit rate calculation is given for the reaction $I + I + A \rightarrow I_2 + A$. Results are compared with those obtained by treating other models of recombination. The validity of the excited intermediate model and the role of electronic degeneracy are discussed. (auth)

20321 LA-2317
Los Alamos Scientific Lab., N. Mex.
A MATHEMATICAL TECHNIQUE FOR THE PRECISION DETERMINATION OF LATTICE CONSTANTS. Richard E. Cogel and Charles P. Kempter. Apr. 1959. 29p. Contract W-7405-eng-36. $1.00(OTS).

An IBM 704 code was developed for the precision determination of crystal lattice constants, using modifications of the Hess method as a basis. No approximations are made in the solution of the observation equation. The method is extended to the hexagonal and orthorhombic crystal systems, to include the diffractometer, and

to additional extrapolation functions for the Debye-Scherrer technique. It was concluded that the Hess method is an excellent approximation for the case which he treated (i.e., that the errors in Φ are directly proportional to Φ for $\Phi \leq 60°$, where Φ is twice the complement of the Bragg angle). In other cases treated, with randomly selected materials, the Hess approximation gave excellent results as compared to the exact technique; however, because of certain restrictions the exact technique is recommended. (auth)

20322 NAA-SR-Memo-3672

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

MESH SIZE IN TRANSPORT CODES. E. U. Vaughan. Mar. 24, 1959. 5p. $1.80(ph), $1.80(mf) OTS.

The kernels of integral equation formulations of transport theory and diffusion theory are compared. It is concluded that the difference between them will not be clearly reflected in digital transport calculations unless there are 4 or 5 mesh points per mean free path. The areas of the repeating units of typical fuel assemblies such as A. and I. type 7, 19, or 37 rod clusters, are about 7 square mean free paths, including a thickness of two mean free paths of moderator, because transport corrections extend about that far. Hence, not many more than 100 mesh points are needed for digital transport calculations for such fuel assemblies. (auth)

20323 NP-7826

Westinghouse Electric Corp. Research Labs., Pittsburgh.

RADIATIVE HEAT TRANSFER IN THERMOELECTRIC MATERIALS. Research Memo 431-FD-410-M1. T. Holstein. Apr. 24, 1959. 9p.

The general expression for the heat conductivity due to radiative transport is listed and developed. (J.R.D.)

20324 NP-7841

Naval Research Lab., Washington, D. C.

NRL QUARTERLY ON NUCLEAR SCIENCE AND TECHNOLOGY. Progress Report for the Period April–June 1959. July 1, 1959. 60p.

The mass, half life, and excited state energies of B^8 were measured. The half life was determined as 0.78 ± 0.01 sec. The reaction $Be^9(He^3,p)B^{11}$ was investigated with a Q value of 10.329 Mev for B^{11} left in its ground state. Data are tabulated on the cross sections for the reaction leaving B^{11} in its ground state and first excited state. Also, differential cross section data are presented graphically. Absolute measurements on $T^3(p,n)He^3$ are reported. The experimental procedure is outlined, and results are discussed. Radiative proton capture was also investigated. Results of experiments using the $O^{18}(d,n\gamma)F^{19}$ and $O^{18}(p,\gamma)F^{19}$ reactions are reported at 6 to 10 Mev. Data are included, and observations at various energies are discussed. The $As^{75}(p,n\gamma)Se^{75}$ reaction at 1.669 and 1.960 Mev was examined, and the $As^{75}(p,n)Se^{75}$ reaction was re-examined at 3 Mev. Calculation of the volume energy and saturation density of nuclear matter is presented. This work is regarded as an extension of the earlier work of Brueckner. The variational method was used to investigate the importance of the exclusion principle. The calculations were performed under the assumption that S-wave scattering alone is sufficient to determine the properties of nuclear matter. The agreement between the empirical values for the properties of nuclear matter is satisfactory. Calculation methods are described, and data are included. (J.R.D.)

20325 NP-7845

Tokyo Univ. Inst. for Nuclear Study.

ELASTIC SCATTERING OF PROTONS BY HELIUM BETWEEN 9.2 MEV AND 14.5 MEV. Junpei Sanada. [1958]. 23p.

Proton scattering by helium was investigated at 9.2 to 14.5 Mev. The full angular distribution curves were taken at 12.04 and 14.32 Mev. Both curves have a minimum at 115° and show the evidence of Coulomb-nuclear interference, though very small, at near 18° in the center of mass system. Tentative phase shift analysis revealed that the D-wave phase shifts are closely related with the shape of angular distribution at forward angles and although they are small, they cannot be neglected. Excitation curves between 9.2 Mev and 14.5 Mev were also taken at four angles of 25°31′, 49°21′, 90° 0′, and 168°41′ in the center of mass system. $k^2\,\sigma(\theta)$ versus energy curves increase gradually with proton energy. They display no new state in Li^5 except the $\frac{1}{2}^-$ first excited state. The differential cross sections at 9.5 Mev have served to resolve the divergence with the values hitherto obtained. (auth)

20326 NP-7857

Massachusetts Inst. of Tech., Cambridge. Solid-State and Molecular Theory Group.

QUARTERLY PROGRESS REPORT NO. 33. July 15, 1959. 59p. Contract Nonr-1841(34).

Work on the isolation of iron-group ions was continued with self-consistent field calculations on Mn^{2+}. Hartree-Fock calculations of Mn^{2+} in cubic fields are tabulated. Earlier calculations on the energy bands of Fe were extended, and some suggestions regarding methods of energy band calculation are given. Studies of the motions of ions in the neighborhood of a missing electron in the valence band of a KCl crystal were extended. Results were obtained which may explain discrepancies in previous works. Progress was continued in the simplification of computer programming techniques and has now reached a point where attention may be directed to the application of methods rather than their improvement. (D.E.B.)

20327 NP-7859

Stanford Univ., Calif. Applied Mathematics and Statistics Lab.

THE SEQUENTIAL DESIGN OF EXPERIMENTS FOR INFINITELY MANY STATES OF NATURE. Technical Report No. 47. Arthur E. Albert. Aug. 3, 1959. 87p. Contract N6ONR-25140.

The work of Chernoff on the statistical aspects of scientific experimentation was extended to the case where possible states of nature are infinite. It is assumed that there are two possible terminal decisions and a class of available experiments. After each observation, the decision must be made as to whether or not to continue. It is shown that under a large class of procedures for choosing experiments, the maximum likelihood estimate is a consistent estimate of the true state of nature. (D.E.B.)

20328 NP-7874

Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.

QUARTERLY PROGRESS REPORT NO. 54. J. B. Weisner, G. G. Harvey, and H. J. Zimmermann. July 15, 1959. 217p. Project 3-99-00-000. Contract DA36-039-sc-78108.

A review is presented of the research activities of the Laboratory for the three-month period ending May 31,

1959. Progress is indicated in the fields of physical electronics, microwave gaseous discharge, plasma dynamics, solid state physics, thermoelectric processes and materials, microwave spectroscopy, nuclear magnetic resonance and hyperfine structure, microwave electronics, statistical communication theory, process analysis and synthesis, processing and transmission of information, statistical thermodynamics, physical acoustics, speech communication, communications biophysics, neurophysiology, and circuit theory. (For preceding period see NP-7580.) (W.D.M.)

20329 OOR-1574.5
Princeton Univ., N. J.
STUDIES OF NATURAL AND INDUCED RADIOACTIVITIES. Final Report. James R. Arnold. June 1, 1959. Includes Papers: THE SEDIMENTARY GEOCHEMISTRY OF THE BERYLLIUM ISOTOPES. John R. Merrill, Edward F. X. Lyden, Masatake Honda, and James R. Arnold. METHODS FOR SEPARATION AND DETERMINATION OF BERYLLIUM IN SEDIMENTS AND NATURAL WATERS. John R. Merrill, Masatake Honda, and James R. Arnold. "SOLAR RADIOACTIVITY" STUDIES. 88p. Contract DA-36-034-ORD-2163.

Two papers are presented describing the study of natural Be^{10} and its application. The beryllium content of ocean red clay sediments, ocean water and some river water samples has been measured, and from this information the residence time of beryllium in the ocean has been calculated. A "solar radioactivity" hypothesis, stimulated by an apparent tenfold excess of natural tritium abundance over that expected from cosmic ray production, is described. It is hypothesized that the excess tritium was carried into the earth's atmosphere in the "solar wind" of material from the sun's corona. The weight of present evidence is against this hypothesis. (auth)

20330 ORNL-2731
Oak Ridge National Lab., Tenn.
STOPPING POWER OF THIN ALUMINUM FOILS FOR 12 TO 127 KEV ELECTRONS. Ford Kalil, W. G. Stone, H. H. Hubbell, Jr., and R. D. Birkhoff. Sept. 16, 1959. 134p. Contract W-7405-eng-26. $19.80(ph), $6.30(mf) OTS.

The stopping power of aluminum for electrons having energies of 10 to 125 kev was studied by measuring the average energy loss directly by calorimetric means. Two different aluminum foils were studied of thicknesses 50.3 and 107.8 $\mu g/cm^2$. At these thicknesses the scattering was not excessive for the incident electron energies used. The maximum path length correction was 20.6%. This was for the thickest foil and lowest incident electron energy. The foils were evaporated foils evaporated rapidly so that their thicknesses were uniform. The maximum measured energy loss was 2.5% of the incident energy and was found for the thicker foil and lowest energy. The minimum measured energy loss was 0.28% of the incident energy. This was for the thinner foil and maximum incident energy. The experimental results gave excellent agreement with Bethe's stopping power theory for the aluminum foils used after path length corrections were made. Since the stopping power of aluminum oxide would not be much different from that of aluminum, according to theory, then any aluminum oxide coating on the foils would not be expected to affect the results significantly. On the basis of these experimental results, it appears likely that Bethe's stopping power theory is accurate for the energy range studied and for light materials. This is to be expected in that the beam energy was always more than five times the ionization potential of the deepest electron shell (K shell ionization potential is 1500 volts in Al). (auth)

20331 ORNL-2732
Oak Ridge National Lab., Tenn.
MEASUREMENT OF ELECTRON FLUX IN IRRADIATED MEDIA BY AC METHODS (thesis). R. A. Finston, H. H. Hubbell, Jr., W. G. Stone, and R. D. Birkhoff. Sept. 14, 1959. 105p. Contract W-7405-eng-26. $16.80(ph), $5.70(mf) OTS.
Submitted to Vanderbilt Univ.

The low-energy secondary electron flux generated within a medium under x irradiation was determined by measuring the derivatives of the current voltage curve of two closely spaced parallel plates irradiated in vacuum. Previously the derivatives had been evaluated directly from the current-voltage curve in work reported by Nelson, Birkhoff, Ritchie, and Hubbell. Now considerably increased accuracy, sensitivity, and electron energy range are obtained by an AC method. Two signals of equal amplitude and frequencies 300 and 324 cps modulate the parallel plate DC bias. The beat frequency amplitude appearing in the secondary electron current is directly proportional to the second derivative of the current-voltage curve. First derivatives were obtained by integrating the second derivatives. The energy spectrum of the electron flux can be immediately calculated from the first and second derivatives. The electron flux spectrum has been measured out to 50 electron-volts in copper and aluminum, and 18 electron-volts in graphite and tissue equivalent conducting plastic. The spectra follow the inverse square dependence with energy for the energy range investigated previously by Nelson, et al. Beyond these energies, the spectra fall off more rapidly than the inverse square of the energy. The total saturation current yield of secondary electrons was measured for heavily filtered x-rays with effective energies ranging from 35 kev to 200 kev. The yields were highly energy dependent when measured in terms of esu $cm^{-2}rad^{-1}$ absorbed in air. However, the yields were relatively energy independent from 45 kev when expressed in terms of esu $cm^{-2}rad^{-1}$ absorbed in the plate media. The yields were 3.1×10^{-4}, 4.9×10^{-4}, 3.9×10^{-4}, 4.2×10^{-4} esu $cm^{-2}rad^{-1}$ absorbed in copper, aluminum, graphite, and tissue equivalent conducting plastic, respectively. (auth)

20332 ORNL-2739
Advisory Committee on Reactor Physics, AEC and Oak Ridge National Lab., Tenn.
PROCEEDINGS OF THE NEUTRON THERMALIZATION CONFERENCE, APRIL 28-30, 1958, GATLINBURG, TENNESSEE. Sept. 2, 1959. 248p. Contract W-7405-eng-26. $4.00(OTS).

20333 ORNL-2739(Paper I-A)
Knolls Atomic Power Lab., Schenectady, N. Y.
CALCULATION OF WIGNER-WILKINS SPECTRA WITH M = 18 KERNEL AND M = 1 SOURCE. T. J. Kreiger, P. F. Zweifel, and D. M. Keaveney. Paper I-A of PROCEEDINGS OF THE NEUTRON THERMALIZATION CONFERENCE, APRIL 28-30, 1958, GATLINBURG, TENNESSEE. 9p.

In an attempt to explain the excellent agreement of measured thermal spectra in water with calculations based on a free monatomic moderator of mass M = 1, a conjecture has been advanced that the calculated spectrum is insensitive to the value of the moderator

mass used in the energy change kernel $\Sigma(E_i \rightarrow E_f)$ of the Wigner-Wilkins integral equation. The truth of this conjecture was investigated by assigning to the protons a mass equal to 18 neutron masses in evaluating the energy change kernel and also in establishing a distribution of initial proton velocities. The source term in the Wigner-Wilkins equation, which represents the neutrons fed into the thermal group from the epithermal region, is, however, calculated with the true proton mass, since the chemical binding is negligible for epithermal neutrons. The integral equation was solved on an IBM-650 computer and the resulting spectra compared with the usual M = 1 spectra. The comparisons indicate that the spectrum is indeed sensitive to the value of the moderator mass used in the energy change kernel. The effect of thermal-cutoff choice and Doppler effect is also shown. (auth)

20334 ORNL-2739(Paper I-B)
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
THERMAL NEUTRON SPECTRUM IN HARMONICALLY BOUND HYDROGEN MODERATORS. E. Richard Cohen and Edward U. Vaughan. Paper I-B of PROCEEDINGS OF THE NEUTRON THERMALIZATION CONFERENCE, APRIL 28-30, 1958, GATLINBURG, TENNESSEE. 20p.

The description of hydrogen moderation by chemically bound hydrogen as described by Bethe was extended to include the Boltzmann distribution of initial hydrogen oscillator states. Because of the discrete energy transfers allowed in the system, the Boltzmann equation for the neutrons can be reduced to independent sets of difference equations. The adjoint equation, which gives the neutron importance is formulated and is used to provide a simple and easily understood formula for the reactivity change with temperature (population of oscillator initial states). The neutron importance is equal to the number of neutrons produced per absorption averaged over the energy at which the neutron is ultimately absorbed. The change in reactivity produced by a change in the population distribution of the hydrogen arises from the differing importance of neutrons with energy. The neutron spectrum and the reactivity were calculated for several cases of interest. (auth)

20335 ORNL-2739(Paper I-C)
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
NEUTRON MODERATION BY CHEMICALLY BOUND HYDROGEN. Edward U. Vaughan and Edward Richard Cohen. Paper I-C of PROCEEDINGS OF THE NEUTRON THERMALIZATION CONFERENCE, APRIL 28-30, 1958, GATLINBURG, TENNESSEE. 17p.

When the moderator is hydrogen with isotropic harmonic oscillator binding, the neutron balance condition and its adjoint, which determine the neutron flux and importance spectra, respectively, take the form of difference equations because of the discreteness and uniform spacing of the harmonic oscillator energy levels. These equations can be reduced to first order difference equations—homogeneous in the case of the flux, inhomogeneous in the case of the importance—provided the hydrogen atoms are all in their ground states (corresponding to absolute zero temperature). By using suitable approximations to the scattering cross sections, the equations can be simplified and solved. The solutions are sufficiently tractable to permit approximate reduction to single sums of the double sums arising in a perturbational treatment of the effect of temperature (through excited states of hydrogen) on reactivity. It can be shown in this way that at room temperature, and for typical hydrogen frequencies, the temperature-dependent part of the reactivity is insensitive to the behavior of the flux and importance for energies more than twice the quantum energy of the hydrogen oscillators. With this simplification, the effect of temperature on reactivity was evaluated for a number of conditions. (auth)

20336 ORNL-2739(Paper II-C)
Argonne National Lab., Lemont, Ill.
THERMALIZATION OF NEUTRONS AT VERY LOW TEMPERATURES. C. N. Kelber. Paper II-C of PROCEEDINGS OF THE NEUTRON THERMALIZATION CONFERENCE, APRIL 28-30, 1958, GATLINBURG, TENNESSEE. 8p.

The slowing down of neutrons in cold moderators to produce neutron beams of low effective temperature was reconsidered. The early analysis by Pomerantschuk in 1938 pointed out one principal difficulty, namely the increase in capture rate attendant upon a decrease in neutron velocity. This limits the attainable temperature in H_2 to about 30°K. In the case of D_2 or D_2O, however, the capture rate is so low that leakage represents the major sink for neutrons. In typical D_2O moderated reactors the capture rate does not become appreciable in a cold, pure sample of D_2 or D_2O until temperatures of the order of 3°K are reached. The principal remaining difficulty is that the cross section for exchange of energy with the crystalline lattice becomes exceedingly difficult at very low temperatures. A greatly simplified model of D_2O was adopted which enables one to compute the inelastic scattering cross section (for one phonon exchange) and, using the methods of Kothari and Singwi the age of thermal equilibrium of neutrons in the cold sample can be computed with the assumption that these neutrons originally had a Maxwellian spectrum characterized by a temperature of 300°K. The age is very large for D_2O at 4°K but should be reasonable for D_2 at the same temperature. The hazards associated with handling D_2 have led to a series of experiments with D_2O. The experimental apparatus and design is discussed, as well as preliminary results. A Monte Carlo calculation of the spectrum expected in the exit beam from a finite block of moderator is discussed. (auth)

20337 ORNL-2739(Paper II-D)
Brookhaven National Lab., Upton, N. Y.
NEUTRON THERMALIZATION IN INFINITE HOMOGENEOUS SYSTEMS. Noel Corngold. Paper II-D of PROCEEDINGS OF THE NEUTRON THERMALIZATION CONFERENCE, APRIL 28-30, 1958, GATLINBURG, TENNESSEE. 9p.

Some of the latest results of a study of neutron thermalization now in progress at BNL are presented. The guiding idea is to carry the study of the Boltzmann equation for the neutron flux as far as possible without resorting to numerical methods or restricting considerations to very heavy gaseous moderators. (auth)

20338 ORNL-2739(Paper II-E)
A REMARK ON NEUTRON THERMALIZATION THEORY. G. Leibfried. Paper II-E of PROCEEDINGS OF THE NEUTRON THERMALIZATION CONFERENCE, APRIL 28-30, 1958, GATLINBURG, TENNESSEE. 11p.

The slowing down of neutrons by a monoatomic moderator gas with temperature can be expressed by a variational formalism. Using a suitable trial solu-

tion one can calculate the effective neutron temperature and the upper limit of the thermal region by variation. Results are given for large moderator masses and small absorption. (auth)

20339 ORNL-2739(Paper II-F)
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
THERMAL NEUTRON FLUX IN A NONABSORBING HEAVY GAS MEDIUM WITH A TEMPERATURE DISCONTINUITY. D. A. Kottwitz. Paper II-F of PROCEEDINGS OF THE NEUTRON THERMALIZATION CONFERENCE, APRIL 28-30, 1958, GATLINBURG, TENNESSEE. 16p.

The energy and spatial dependence of the steady state neutron flux was derived for a nonabsorbing infinite gaseous medium in which the medium temperature is a step function of position. In the heavy gas and diffusion approximations, the energy dependent transport equation reduces to a second order partial differential equation which is separable in each region of constant temperature. The solution is a series of eigenfunctions, the leading term of which is Maxwellian in form. From general properties of the differential equation, it can be shown that the total flux (integrated over all energies) is independent of position. This latter result is in agreement with the theory of irreversible processes. (auth)

20340 ORNL-2739(Paper III-A)
Brookhaven National Lab., Upton, N. Y.
INELASTIC SCATTERING OF SLOW NEUTRONS IN MODERATORS. D. J. Hughes, A. M. Ghose, H. Palevsky, and P. Kienle. Paper III-A of PROCEEDINGS OF THE NEUTRON THERMALIZATION CONFERENCE, APRIL 28-30, 1958, GATLINBURG, TENNESSEE. 23p.

The details of the energy exchanges between slow neutrons and lattice vibrations are important in determining the manner in which moderation occurs and the neutron energy spectrum in different geometries. Measurements have been in progress for several years at Brookhaven in which the lattice vibrations are studied by means of the energy gain of incident cold neutrons. The cold neutrons, of energy 0.004 ev, are produced by filtration in cooled polycrystalline beryllium and the velocity of the scattered neutrons is determined by time of flight. For a single crystal of a coherent scattering material, the frequency of the phonons as a function of their wave number, i.e., the dispersion law, may be measured for both acoustical and optical vibrations. For incoherent scatterers the lattice vibration spectrum is obtained directly but not the detailed dispersion law. Measurements were made for a number of moderators, among which ZrH exhibits an intense optical lattice vibration at an energy of 0.134 ev. (auth)

20341 ORNL-2739(Paper III-B)
General Atomic Div., General Dynamics Corp., San Diego, Calif.
NEUTRON THERMAL INELASTIC SCATTERING BY BOUND ATOMS. A. W. McReynolds. Paper III-B of PROCEEDINGS OF THE NEUTRON THERMALIZATION CONFERENCE, APRIL 28-30, 1958, GATLINBURG, TENNESSEE. 20p.

In the energy range below about 1 ev, the cross section (k,k',T) for scattering of a neutron with propagation vector k, relative to the scatterer at temperature T, to k' is no longer characteristic of free atoms but dependent on interatomic binding forces. Using monoenergetic neutron beams, ranging from 0.05 to 0.3 ev, from crystal spectrometers at Brookhaven National Laboratory this dependence was studied by measurements of total cross section, the angular distribution, and the average scattered energy for H in various chemical bonding states for C and Be. H in H_2O behaves qualitatively as if free, with smooth variation of both total cross section and energy loss. The tighter binding of H in $ZrH_{1.5}$ gives discrete energy states, 0.13 ev, characteristic of an isotropic harmonic oscillator. Energy loss per collision is negligible for neutrons of lower energy but has maxima at the 0.13, 0.26, etc., levels. There are corresponding peaks in total cross section above these energy thresholds in agreement with Fermi's theoretical curve. For carbon the predominance of elastic diffraction scattering over inelastic necessitates higher resolution techniques. These show the product of cross section and energy loss per collision lower by about a factor of 3 than the values for free carbon. (auth)

20342 ORNL-2739(Paper III-C)
General Atomic Div., General Dynamics Corp., San Diego, Calif.
A STUDY USING TIME-OF-FLIGHT TECHNIQUES OF THE THERMAL INELASTIC SCATTERING OF NEUTRONS. William L. Whittemore. Paper III-C of PROCEEDINGS OF THE NEUTRON THERMALIZATION CONFERENCE, APRIL 28-30, 1958, GATLINBURG, TENNESSEE. 16p.

In order to make a complete calculation of the thermalization of neutrons, one needs a detailed notion of the interaction between the neutron and the system of atoms in the moderating substance. As part of an investigation of the thermalization process, a study was made by neutron time-of-flight techniques on the energy spectrum of neutrons scattered at 90 degrees by several materials, including zirconium hydride, water, and carbon. Two types of these measurements were made in which the significant difference is the energy of the incident neutron. (auth)

20343 ORNL-2739(Paper IV-A)
General Electric Co. [Vallecitos Atomic Lab.], San Jose, Calif.
NEUTRON THERMALIZATION CALCULATIONS FOR A HETEROGENEOUS LATTICE CONSISTING OF RODS OF URANIUM AND PLUTONIUM FUEL IN WATER. Paul Greebler. Paper IV-A of PROCEEDINGS OF THE NEUTRON THERMALIZATION CONFERENCE, APRIL 28-30, 1958, GATLINBURG, TENNESSEE. 16p.

Calculated temperature and steam void coefficients of reactivity are highly sensitive to the techniques employed to obtain thermal cross sections, especially with the presence of a strongly non-1/v absorber such as Pu^{239}. Thermal neutron spectra are calculated for a heterogeneous lattice of a low enrichment boiling water reactor. Using blackness theory, equivalent homogeneous, monoenergetic cross sections for the lattice are computed at closely spaced energy intervals over the thermal energy range. The energy distribution of the thermal neutron flux is then obtained using both the Wigner-Wilkins and the Wilkins thermalization equations. Calculations are made with the fuel elements assumed to contain only U^{235} and U^{238} yielding almost pure 1/v absorption, and also for the case of appreciable Pu^{239} present in addition to the uranium, resulting in a significant departure from 1/v absorption. Sensitivity of the calculated spectrum to the effective mass

of the hydrogen is tested by allowing wide variations of the $\xi\sigma_s$ values for water at low energies in several applications of the Wilkins equation. Variations in the thermal-neutron spectra resulting from the choice of the thermalization equation, from changing $\xi\sigma_s$, or as a result of plutonium buildup are evaluated in terms of isotopic and total cross sections averaged over the spectrum in each case. (auth)

20344 ORNL-2739(Paper IV-B)
Knolls Atomic Power Lab., Schenectady, N. Y.
THE INFLUENCE OF NON-1/v ABSORBERS ON REACTOR PARAMETERS. T. J. Krieger, P. F. Zweifel, M. L. Storm, and D. M. Keaveney. Paper IV-B of PROCEEDINGS OF THE NEUTRON THERMALIZATION CONFERENCE, APRIL 28-30, 1958, GATLINBURG, TENNESSEE. 10p.

The development of the SOFOCATE code for the IBM-704 computer has greatly facilitated the calculation of thermal spectra and associated average cross sections in assemblies containing non-1/v absorbers. The code is particularly useful when isotopes with low-lying resonances (<2ev), e.g., Eu, Pu^{239}, are present, since by extending the "thermal" range to include these resonances, it is possible to analyze their effects in a more accurate and convenient way than has heretofore been available. This expedient was employed in the analysis of the comparative xenon poisoning of U^{235}- and Pu^{239}-fueled assemblies, and also in the calculation of the influence of Eu on the temperature defect of a reactor. Results of the former study show that, because of the favorable competition of the 0.3 ev Pu fission resonance relative to the Xe captures, the control invested in overcoming peak xenon is greater in a U^{235} assembly than in the comparable Pu^{239} assembly. In the latter problem, the change in the temperature defect of a reactor upon addition of Eu is found to be dependent on the degree of spectral hardening. This dependence is directly attributable to the 0.4 ev Eu resonances. In both problems, the thermal cutoff energy in the SOFOCATE calculations was chosen to be 1.0 ev, which has the effect of yielding lower values for the various cross sections than those usually used. (auth)

20345 ORNL-2739(Paper IV-C)
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
MEASUREMENT OF NEUTRON SPECTRA IN REACTORS. M. J. Poole. Paper IV-C of PROCEEDINGS OF THE NEUTRON THERMALIZATION CONFERENCE, APRIL 28-30, 1958, GATLINBURG, TENNESSEE. 12p.

A method is developed for the prediction of neutron spectra in reactors by exciting a sub-critical assembly with a pulsed source, and performing a neutron time-of-flight experiment on a beam extracted from this assembly. Results obtained by this method are presented and compared with results obtained by more conventional means. (auth)

20346 ORNL-2739(Paper IV-D)
Knolls Atomic Power Lab., Schenectady, N. Y.
LOW ENERGY SPECTRA MEASUREMENTS. R. E. Slovacek and R. S. Stone. Paper IV-D of PROCEEDINGS OF THE NEUTRON THERMALIZATION CONFERENCE, APRIL 28-30, 1958, GATLINBURG, TENNESSEE. 28p.

Thermal neutron spectra were measured using the slow chopper time-of-flight technique. Spectra were obtained over an energy range from 10^{-2} to 10 ev for pure water and for a nearly homogeneous subcritical assembly where the ratio of the thermal absorption to the high energy scattering cross section was approximately 0.3. For each medium, spectra were measured at 298°K and 586°K. The technique of measuring spectra in a subcritical assembly at elevated temperatures with a slow chopper is presented. The advantages and limitations of this method are discussed. The various corrections that have been applied to the data are discussed. The experimental results are presented and compared with results of calculations using the SOFOCATE code. The agreement between theory and experiment is excellent for the multiplying media. On the basis of this agreement, one concludes that chemical binding effects in light water play a negligible role in determining the equilibrium neutron spectrum in water assemblies. (auth)

20347 ORNL-2739(Paper IV-E)
General Atomic Div., General Dynamics Corp., San Diego, Calif.
MEASUREMENT OF LOW ENERGY NEUTRON SPECTRA USING A PULSED NEUTRON SOURCE. R. S. Stone and J. R. Beyster. Paper IV-E of PROCEEDINGS OF THE NEUTRON THERMALIZATION CONFERENCE, APRIL 28-30, 1958, GATLINBURG, TENNESSEE. 7p. (GAMD-348).

A program of measurements of low energy neutron spectra in moderators and typical sections of reactor cores is being planned to begin at General Atomic during the summer of 1958. This work will use the new high current 30 Mev electron linear accelerator to produce a very intense pulsed neutron source. The initial measurements of spectra will be done on hydrogen moderated systems both poisoned and unpoisoned. The characteristics of the linear accelerator and supporting facilities are described. The general features of the experimental program are discussed and the two experimental techniques to be used in performing the spectral measurements are outlined. (auth)

20348 ORNL-2783
Oak Ridge National Lab., Tenn.
THERMOLUMINESCENCE STUDIES OF THE GAMMA-IRRADIATED FERROELECTRICS ROCHELLE SALT AND GUANIDINE ALUMINUM SULFATE HEXAHYDRATE. J. W. Gilliland, Jr. Sept. 9, 1959. 52p. Contract W-7405-eng-26. $1.50(OTS).

Samples of Rochelle salt and guanidine aluminum sulfate hexahydrate were irradiated with various doses of Co^{60} gammas up to 3.5×10^6 r at liquid nitrogen temperature after which they were warmed at a constant rate and observed with a 1P28 photomultiplier tube. Pure Rochelle salt single crystals were found to yield no thermoluminescence glow which is detectable, and it is estimated that the minimum amount of detectable luminescence by the method used is less than 10,000 photons per second. The reagent grade Rochelle salt powder was found to produce a glow peak at about −61°C which was removed completely by two recrystallizations from water solution. This peak corresponds to a trap depth of about 0.42 ev. Guanidine aluminum sulfate hexahydrate showed three glow peaks at −146°C, −119°C, and about −5°C, corresponding to trap depths of 0.25 ev, 0.31 ev, and 0.54 ev, respectively. The major peak at −146°C becomes more prominent as the dose is increased to 3.5×10^6 r. At low doses (10,000 r) the −119°C peak is largest but becomes completely con-

cealed by the lower temperature peak at 3.5×10^6 r. The low and very broad peak at −5°C is most easily seen at intermediate doses of 10^5 and 10^6 r. At lower doses it becomes undetectable, and at higher doses it is poorly resolved because of interference from a low diffuse glow following the large peak at −146°C and from spurious signals. The spurious signals observed from Rochelle salt on an oscilloscope were found to be of the order of 10 μsec duration. It is suggested that these spurious signals may be the result of triboluminescence in the crystal produced by thermal expansion or contraction. (auth)

20349 PIBAL-489
Brooklyn. Polytechnic Inst.
CREEP BUCKLING OF CYLINDRICAL SHELLS SUBJECTED TO UNIFORM AXIAL COMPRESSION. Francis W. French and Sharad A. Patel. May 1959. 17p. Project No. 9782. Contract AF49(638)-302. (AFOSR-TN-59-538; AD-215555).

The axially symmetric creep buckling of a circular cylindrical shell is investigated. A sandwich shell analogy and a biaxial creep law are used in the analysis. Two simultaneous, nonlinear differential equations are found to govern the stress distribution in and the displacement of the cylinder. A numerical example using these equations is carried out, and the results are presented in the form of curves. (auth)

20350 RADC-TR-59-47
Syracuse Univ., N. Y. Research Inst.
DIAGNOSIS OF EQUIPMENT FAILURES. Technical Report I. Richard A. Johnson, Earl Kletsky, and John Brulé. Apr. 1, 1959. 74p. Contract AF30(602)-1833. (SURI-EE-577-594T1-AD-213876).

This investigation was mainly concerned with one phase of the maintenance problem of electronic equipment, namely, the problem of determining which part of the equipment is in need of repair when the equipment as a whole does not function properly. This work was undertaken in the hope that examination of the basic fundamentals of diagnostic procedures would permit substantial economies to be made in the diagnostic phases of maintenance. (W.L.H.)

20351 SCTM-127-59(14)
Sandia Corp., Albuquerque, N. Mex.
IMPEDANCE OF A DIPOLE IN AN IONIZED MEDIUM—I. Charles W. Harrison, Jr., and David H. Denton, Jr. Apr. 1, 1959. 13p. Contract [AT(29-1)-789]. $3.30 (ph), $2.40(mf) OTS.

The theory applicable to perfectly conducting, symmetrical, center-driven antennas of finite dimensions immersed in an infinite ionized medium of low attenuation is developed. The theory also applies to base-driven radiations in such a medium when oriented at right angles to an infinite perfectly conducting plane. (auth)

20352 TID-3536
Technical Information Service Extension, AEC.
FISSION PRODUCTS DECAY ENERGY. A Literature Search. James M. Jacobs, comp. Sept. 1959. 11p. $0.50(OTS).

Seventy-five unclassified reports concerning energy release in various forms from irradiated materials are cited. The references are grouped alphabetically by corporate author (issuing agency) and are arranged alpha-numerically by primary report number within each grouping. The primary report number is that number under which the report was cataloged by the Technical Information Service Extension (TISE). (auth)

20353 WAPD-TM-191
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
ISOTOPIC CONCENTRATIONS FOR A TIME-VARYING IRRADIATION OF URANIUM OR PLUTONIUM. S. B. Gunst. Aug. 1959. 38p. Contract AT-11-1-GEN-14. $1.25(OTS).

Expressions for isotopic concentrations as functions of irradiation are derived for uranium and plutonium having any initial isotopic composition. Fourteen isotopes including nine heavy elements and five fission products are considered. The decay of certain isotopes with half lives in the range from two hours to 13.2 years is taken into account as is the specific time-varying irradiation history. The expressions presented are applicable to any irradiation described by a succession of steps during which the thermal flux and epithermal flux are constant for each step but may vary from step to step. Expressions are also presented for quantities related to the isotopic concentrations including (1) the number of fissions in each fissionable isotope during each irradiation step; (2) the corresponding megawatt days per ton (of fuel initially present); (3) the accumulated fissions and megawatt days per ton, both isotopic and total; (4) the thermal, epithermal, and total conversion ratios present at the end of each irradiation step; and (5) the fractional changes in both η and ηf as a result of irradiation and as functions of time after removal from the high flux. A code for the Bell Interpretive System on the IBM-650 digital computer is described for the calculation of the isotopic concentrations and the related quantities. (auth)

20354 WAPD-V(FBE)-226
Vitro Engineering Co., New York.
THIRD COMPILATION OF CURRENT WORK ON TRANSIENT BOILING. Report No. 3. S. K. Hellman, S. Kaminsky, and R. W. Kupp. [1959]. 17p. For Westinghouse Electric Corp. Bettis Atomic Power Div. Subcontract 73(14-1025). $3.30(ph), $2.40(mf) OTS.

The third and final review on boiling heat transfer and related topics presently being investigated is presented. At North Carolina State College, several experiments were conducted and are planned for a program aimed at controlling variables that affect boiling heat transfer. Abstracts of papers obtained from program participants are included, and data on uniform rod burnout are presented along with data on bubble properties. (J.R.D.)

20355 AEC-tr-3650
THEORY OF CURRENT IN VACUUM. I. THE CASE OF PLANE PARALLEL ELECTRODES. S. V. Bellyustin. Translated for Los Alamos Scientific Lab. from Zhur. Eksptl'. i Teoret. Fiz. 9, 742-59(1939). $4.80(ph), $2.70(mf) JCL or LC.

The motion of electrons with equal initial velocities between two infinite parallel plane electrodes is investigated. The potential distribution, field, space charge, and transmit time of electrons are determined. (auth)

20356 AEC-tr-3673
STUDY OF THE EQUILIBRIUM OF A CYLINDRICAL RELATIVISTIC BEAM OF HIGH INTENSITY. (Etude de l'Equilibre d'un Faisceau Cylindrique Relativiste de Forte Intensite.) P. Gratreau and Ch. Maisonnier. Translated for Oak Ridge National Lab., from CEA Re-

port PG-CM 1/JML. 7p. $1.80(ph), $1.80(mf) JCL or LC.

Conditions for electron beam equilibrium are considered. The space charge is taken into account, and an equilibrium relationship is developed mathematically. (J.R.D.)

20357 AEC-tr-3674
A STUDY OF RELATIVISTIC BEAMS. (Etude des Faisceaux Relativistes.) P[ierre] Gratreau. Translated for Oak Ridge National Lab. from CEA report PG/GC PG.1. 6p. $1.80(ph), $1.80(mf) JCL or LC.

With a sufficiently accelerated beam of electrons, a low density of positive ions is sufficient for focalization; the more relativistic the electrons the lower the required density. Grouping the Gaussian formulas of electronic optics relative to intense relativistic beams in a vacuum is proposed, and some cases of integration are indicated. The problem of ionic focusing of such beams is considered. (W.D.M.)

20358 AEC-tr-3675
STUDY OF RELATIVISTIC BEAMS RELATIVISTIC GENERALIZATION OF PIERCE'S EQUATION. (Generalisation Relativiste de l'Equation de Pierce.) Pierre Gratreau. Translated for Oak Ridge National Lab. from CEA report PG/JD PG.2. 4p. $1.80(ph), $1.80 (mf) JCL or LC.

The general equation is established for the electronic trajectories of a beam of revolution subjected to electric and magnetic fields defined on the axis. Gauss's approximation is used: central rays slightly inclined on the axis. Space charge is taken into account, and the relativistic range is considered. (W.D.M.)

20359 AEC-tr-3696
POSSIBLE MECHANISMS OF PARTICLE ACCELERATION IN HIGH-FREQUENCY DISCHARGES. (Mecanismes Possibles d'Acceleration de Particules dans les Decharges de Haute Instensite). Ch. Maisonnier. Translated for Oak Ridge National Lab. from CEA Report ChM/GC PA 6912. $3.30(ph), $2.40(mf) JCL or LC.

The phenomenon of x-ray production in intense discharges in rarefied gases is examined. X rays are regularly produced at definite instants during the discharge, from which it is assumed that certain electrons acquire an energy of about 500 kev. The interval composition parameters of rectilinear discharges under study are listed. A mechanism is proposed which involves the calculation of the electric field induced on the axis by the radial contraction or expansion of a cylinder which is devoid of plasma. During the first contraction, the absence of ionized particles in the vicinity of the axis and the relatively high pressure which is present in this region usually make the acceleration phenomenon unobservable. However, a reduced accelerating voltage exists, which explains the sporadic appearance of x rays during the first contraction. (J.R.D.)

20360 AEC-tr-3702
THEORY OF RELAXATION PHENOMENA IN SOLIDS. B. N. Finkel'shtein and N. S. Fastov. Translated from Doklady Akad. Nauk S.S.S.R. 71, 875-8(1950). 6p. $1.80(ph), $1.80(mf) JCL or LC.

A theory of relaxation in solids formed on the basis of general thermodynamic considerations analogous to those brought forward in the theory of sound absorption in liquids is presented. When the strained state is changed in an elastic body with ultimate speed, a deviation from the static equilibrium takes place at every moment. An expression for the relaxation tensor is given and developed in terms of body state isothermal changes. (J.R.D.)

20361 AEC-tr-3763
CONCERNING THE ELECTONIC STATES OF HIGH-HARDNESS SUBSTANCES HAVING THE STRUCTURE OF SODIUM CHLORIDE. Heinz Bilz. Translated for Los Alamos Scientific Lab. from Z. Physik 153, 338-58(1958). 22p. $4.80(ph), $2.70(mf) JCL.

The energies of the electronic states as functions in momentum space using a bond model were calculated for materials having an NaCl type structure. An explanation of the empirical behavior based on the distribution on an energy scale of states is presented. The extent to which the representation of a half-bonding which is dependent on directed valences is useful, and its application for typically metallic effects is shown. (J.R.D.)

20362 AEC-tr-3766
SOME PROBLEMS IN THE THEORY OF NONLINEAR OSCILLATIONS. (Nekotorye Zadachi Teorii Nelineinykh Kolebanii.) I. G. Malkin. Translated from a publication of the State Publishing House of Technical and Theoretical Literature, Moscow, 1956. Issued in two books: 268p. (Bk. 1) and 321p. (Bk. 2). $3.00(OTS).

The "method of small parameter" is systematically applied to the solution of a number of problems in the theory of nonlinear oscillations. Theories are set forth on periodic and almost periodic oscillations of quasilinear systems with one and several degrees of freedom, periodic and almost periodic oscillations of systems approximating arbitrary nonlinear systems, and free and forced oscillations of quasiharmonic systems. All problems considered are done so with sufficient mathematical rigor. (W.D.M.)

20363 AEC-tr-3771
DISTRIBUTION ON SPACE CHARGE IN EMISSION TUBES. M. Matricon and S. Trouvé. Translated for Los Alamos Scientific Lab. from Onde elec. 30, 510-21 (1950). 23p. $4.80(ph), $2.70(mf) JCL.

Approximate formulas were established for the value of the electron current emitted by the cathode as a function of the anode voltage, for cathode structures of practical importance. In the case of a cylindrical cathode filament parallel but not coaxial with the anode, an experimental verification was made. (auth)

20364 AEC-tr-3775
INVESTIGATION OF THE NATURE OF CONCENTRATION QUENCHING OF DYESTUFFS IN VARIOUS SOLVENTS AND CLASSIFICATION OF DIFFERENT TYPES OF QUENCHING. V. L. Levshin and E. G. Baranova. Translated by Lydia Venters (Argonne National Lab.) from Optika i Spektroskopiya 6, 55-64(1959). 20p. $3.30(ph), $2.40(mf) JCL or LC.

Different types of transfer of the excitation energy between the molecules in concentrated solutions of a luminescent substance which lead to the quenching and depolarization of the luminescence are discussed. The separation of the effect of energy transfer between monomer and monomer, between monomer and dimer or higher associates, and that of the effect of inactive absorption of nonluminescent associates was carried out. The development of the indicated quenching processes in different solvents, which produce different association stages at the given concentration of the solution, is discussed. (auth)

20365 AEC-tr-3776
ON THE LUMINESCENCE DECAY LAW FOR POLYSTYRENE AT ELECTRON EXCITATION. S. F. Kilin and Y. M. Rozman. Translated by Lydia Venters (Argonne National Lab.) from Optika i Spectroskopiya 6, 65-9(1959). 10p. $1.80(ph), $1.80(mf) JCL or LC.

It was demonstrated by means of a multifrequency fluorimeter with a modulated electron beam that scintillations in polystyrene are quenched not according to the simple exponential law. The results obtained contradict Birk's theory and coincide sufficiently with the assumption relative to the essential role of bimolecular quenching in the process of scintillations. (auth)

20366 AEC-tr-3777
INFLUENCE OF REABSORPTION ON THE FLUORESCENCE DURATION OF ORGANIC SUBSTANCES. S. F. Kilin and I. M. Rozman. Translated by Lydia Venters (Argonne National Lab.) from Optika i Spektroskopiya 6, 70-7(1959). 15p. $3.30(ph), $2.40(mf) JCL or LC.

An investigation of the radiation kinetics of luminescence of plastic scintillators with polystyrene as the basic material is presented. It was demonstrated by means of a multifrequency phase fluorimeter that the fluorescence of tetraphenylbutadiene and triphenylpyrazoline in polystyrene in the presence of appreciable reabsorption is quenching according to an exponential law. The results of measurements of the mean duration of fluorescence, external luminescence spectra, and quantum yield are in agreement with the computation. (W.L.H.)

20367 AEC-tr-3779
DELAYED LUMINESCENCE OF DIBENZYL AND DIPHENYLAMINE CRYSTALS ON PHOTO- AND β-EXCITATION. T. P. Belikova. Translated by Lydia Venters (Argonne National Lab.) from Optika i Spektroskopiya 6, 117-18(1959). 4p. $1.80(ph), $1.80(mf) JCL or LC.

The delayed luminescence of dibenzyl and diphenylamine crystals on photoexcitation and on excitation with fast electrons was investigated. The mean lifetime τ was calculated from the curves obtained: for dibenzyl $\tau = 0.85 \pm 0.02$ sec and for diphenylamine $\tau = 0.35 \pm 0.02$ sec. (W.L.H.)

20368 AEC-tr-3780
THE SEVENTH CONFERENCE ON LUMINESCENCE (CRYSTAL PHOSPHORS). Ch. V. Lushchik and A. V. Moskvin. Translated by Lydia Venters (Argonne National Lab.) from Optika i Spektroskopiya 6, 122-4 (1959). 9p. $1.80(ph), $1.80(mf) JCL or LC.

The papers presented at this conference are briefly reviewed. (W.L.H.)

20369 CEA-tr-R-309
QUELQUES PARTICULARITÉS DU PHOTO-COURANT DANS LES MONOCRISTAUX DU SULFURE DE CADMIUM. (Some Peculiarities of the Photocurrent in Monocrystals of Cadmium Sulfide.) S. M. Ryvkin (Ryvkine) and L. G. Paritskii (Paritzky). Translated into French by B. Vinogradoff from Zhur. Tekh. Fiz. 24, 3-17(1954). 27p.

The phenomena of diffusion and of the deviation of charge carriers were investigated in cadmium sulfide monocrystals. The existence of the deviation of charge carriers was proved by measurements of the potential distribution along the crystal sample with a partial lighting. The results showed that electron deviation causes an increase of the conductivity in the anode region and a decrease of the voltage drop in the same region. The "photo rectification effect" of CdS crystals, the dependence of the induced current on the area of the crystal activated by radiation, was studied and two hypotheses to explain the phenomenon were proposed. An expression describing the relationship of the voltage drop between the first intercalary layer and the anode and the current density is derived for lighting the cathodic region of the crystal. The photocurrent in nonhomogeneous bodies or irregularly lighted bodies, in which the current–lighting function is perturbed, is considered. The effect of extinction, induced by infrared radiation, on the photocurrent curve also causes an anomaly in the current–lighting curve, and it is discussed as a function of light intensity. The positive nonadditivity of photocurrents under the action of two light beams and the photoactivation effect is described. The effect of supplementary light on the efficiency of counting alpha particles by CdS crystals is also discussed. (J.S.R.)

20370 CEA-tr-R-310
PHOTO-RÉSISTANCE DES MONOCRISTAUX DE CdS ET LEUR ACTIVATION PAR LA LUMIÈRE. (Photoresistance of Monocrystals of CdS and their Activation by Light.) V. F. Lashkarev (Lachkarev), V. S. Medvedev, A. I. Skopenko, G. A. Fedoros (Fedorousse), and M. K. Sheinkman (Cheinkman). Translated into French by B. Vinogradoff from Doklady Akad. Nauk S.S.S.R. 86, 905-7(1952). 7p.

The spectral distribution of the photoactivation of resistance elements in CdS monocrystals was studied. In the visible part of the spectrum the experiments were made with simultaneous illumination of the crystals by two monochromators. The photoactivation of the crystal induced by light of different wave lengths and the spectral distribution of the photosensitivity of the crystal activated by light were evaluated and the results are graphed. A lowering of the sensitivity is observed for the short wavelengths of the spectrum. The secondary illumination increases the crystal sensitivity. Measurements of the reflection coefficient of CdS show that in the region of fundamental absorption the crystal absorbs at least 80% of the incident light. The spectral distribution of the crystal sensitivity was also determined in the ultraviolet region of the spectrum from 0.4 to 0.21μ. (J.S.R.)

20371 CEA-tr-R-656
DISTRIBUTION DES ATOMES NEUTRES DANS LE PLASMA D'UN ARC À COURANT CONTINU. (Distribution of Neutral Atoms in the Plasma of an Arc with Continuous Current.) E. I. Nikonova and V. K. Prokof'ev (Prokofiev). Translated into French by B. Vinogradoff from Optika i Spektroskopiya 6, 253-4(1959). 5p.

The distribution of neutral sodium atoms in cross sections of a continuous current arc plasma was investigated as a function of the distance from the cathode. The sodium atom concentration was measured by the dispersion of light directed at right angles to the arc. The results showed that at a distance of 2 mm from the cathode ($\frac{1}{6}$ of the distance between the electrodes) an increase in the concentration of sodium atoms started. The distribution in a right section of the arc at a distance of 2 mm from the cathode was also determined. The maximum concentration found was 1.4×10^{15} cm^{-3}. The concentration in the median section was estimated to be 0.5×10^{15} cm^{-3}. The results indicated that the distribution in the vicinity of the cathode is homogeneous. (J.S.R.)

20372 NP-tr-282

INTRODUCTION TO COSMIC GAS DYNAMICS. F. A. Baum, S. A. Kaplan, and K. P. Stanyukovich. Translated from p.1-175 of Vvedeniye v Kosmicheskuyu Gazodinamiku, State Publishing House for Physicomathematical Literature, Moscow, 1958. 657p.

Methods of gas dynamics which may be useful in solving astrophysical and certain physical problems are presented. Slight attention is devoted to flow past bodies; but unsteady gas flow, gas motion in the gravitational field, and gas motion in the magnetic field are considered in detail. Part I states the fundamentals of gas dynamics as applied to the problems of the motion of cosmic masses in the absence of magnetic fields. Shock wave theory and unsteady gas flow theory are considered, and special attention is devoted to the study of gas motion in a gravitational field. Applications of theoretical methods to nonstationary stars and to geophysical problems are given. (Part II discusses the fundamentals of magnetogasdynamics, the study of the motion of current-conducting gas in a magnetic field. Modern statistical theory of turbulence is discussed, and data are given on the applications of the theory to certain astrophysical problems. Part III discusses the fundamentals of relativistic gas dynamics and magnetogasdynamics. (D.E.B.)

20373 NP-tr-285

THEORY OF FINITE AND INFINITE GRAPHS. COMBINATORIAL TOPOLOGY OF LINEAR COMPLEXES. Dénes Koenig. Translated from p.1-261, Vol. 16, of Akademische Verlagsgesellschaft M.B.H., Leipzig, 1936. 340p. OTS.

The theory of graphs can be conceived from two different viewpoints. First, considered as the theory of one-dimensional complexes, it forms the first part of general topology. Secondly, the theory of graphs can be conceived, disregarding its continuous geometric content, as a branch of combinatorics and of the abstract law of quantics. The second viewpoint is emphasized mainly by attributing no geometric content at all to the elements of the graphs. A certain training in mathematical thinking is required for understanding the content but accurate knowledge of mathematical theorems and concepts, as far as the treatment of finite graphs is concerned, is unnecessary. (W.D.M.)

20374 SCL-T-263

THE DIFFUSION OF MOIST AIR THROUGH SMALL ORIFICES. C. H. Johansson and G. Persson. Translated by K. R. Fortman (Los Alamos Scientific Lab.) from IVA 14, 160-5(1943). 10p. $1.80(ph), $1.80(mf) JCL.

An experimental investigation of various materials is presented regarding the speed with which moisture in the air can penetrate small openings. The diffusion of moisture through small openings and thin columns depends to a large extent on the desorption from the surface of solid bodies of the adsorbed layers of moisture. (W.L.H.)

20375

NEAR-INFRARED SPECTROSCOPY WITH THE BECKMAN DU SPECTROPHOTOMETER. W. E. Shuler, E. I. du Pont de Nemours and Co., Aiken, S. C.). Anal. Chem. 31, 1604-5(1959) Sept.

The use of a small portion of the sensitive area of lead sulfide cells permits modification of the Beckman DU spectrophotometer for near-infrared studies at a modest outlay. Description and operation of the system are presented. (C.J.G.)

20376

A METHOD OF β-RAY DOSIMETRY BASED ON EXAMINING THE ELECTRON SPECTRA. K. K. Aglintsev, and V. P. Kasatkin. Atomnaya Energ. 7, 138-43(1959) Aug. (In Russian)

A β-dosimetry method is suggested based on studies of electron spectra. A scintillation spectrometer was used. It is shown that the magnitude of the dose is equal to N(dE/dx), where N is the number of β particles penetrating an infinitesimally small volume near the examined point; (dE/dx) is the magnitude of ionization losses averaged over the spectrum. It is found that the magnitude (dE/dx) is determined by the maximum energy of the isotope β spectrum. It actually does not depend on the depth of the medium and diameter of the source. Graphs are plotted for S^{35}, W^{185}, Tl^{204}, Y^{91}, and Ce^{144} depth doses, and criteria are suggested for selecting isotopes for optimum irradiation conditions. (tr-auth)

20377

ON THEORY OF SHOCK WAVES. G. Ya. Galin (Lomonosov Moscow State Univ.). Doklady Akad. Nauk S.S.S.R. 127, 55-8(1959) July 1. (In Russian)

The equation of motion, written after first integration, for the shock front structure and width with considerations for viscosity and heat conductivity is analyzed as a continuous solution for media with arbitrary equation of state and effect, resulting from the assumption that these shock transitions are the limit of the continuous solutions. (R.V.J.)

20378

DISCOVERY OF ABOUT 10-kev ELECTRONS IN THE UPPER ATMOSPHERE BY MEANS OF THE THIRD EARTH SATELLITE. V. I. Krasovskiĭ, I. S. Shklovskiĭ, Yu. I. Galperin, and E. M. Svetlitzkii (Inst. of Atmospheric Physics, Academy of Sciences, U.S.S.S.R.). Doklady Akad. Nauk S.S.S.R. 127, 78-81(1959) July 1. (In Russian)

Recordings were taken of 10-kev electrons at 470 to 1880 km elevation. The highest intensity was recorded over the geomagnetic equator at 1330 m. At an "equivalent" energy of 20 kev, the minimum current was about 10^{-4} a/cm−steradian. At the mean and polar latitudes up to 60° geomagnetic, during the night, the current of electrons with an "equivalent" energy of 12 kev was about 15×10^{-11} a/cm^2−steradian and sometimes more than 10^{-10} a/cm^2−steradian. The electron flux relation to "equivalent" energy at 42 to 54° geomagnetic latitude at 1720 to 1880 km over the southern part of the Pacific Ocean, on the night of May 5, 1958, was plotted. (R.V.J.)

20379

THE DEPENDENCE OF THE FORBIDDEN ZONE WIDTH ON THE COMPOSITION OF THE SOLID SOLUTION IN THE InSb−GaSb SYSTEM. V. I. Ivanov-Omskiĭ and B. T. Kolomiets (Inst. of Physics and Tech., Academy of Sciences, U.S.S.R.). Doklady Akad. Nauk S.S.S.R. 127, 135-6(1959) July 1. (In Russian)

The relation between the forbidden zone width and the composition of solid solutions of InSb with GaSb was measured by optical filtration. Large single-phase crystals 100 μ thick and 20 to 30 mm^2 area were prepared by zone alignment. The absolute filtration of the best specimen was 30%. The forbidden zone width rises monotonously and non-linearly. For 50% InSb−50%

GaSb the relation is determined by the absorption band edge displacement at 77 to 330°K. The temperature coefficient of the forbidden zone width dE/dT is 4.5×10^{-4} ev/degree. The width of the forbidden zone determined by the temperature conductivity range and Hall effect was 0.45 ev and by optical measurements was 0.33 ev. (R.V.J.)

20380

A SOLUTION TO CAUCHY PROBLEM FOR THE KINETIC EQUATION OF ELECTRON PLASMA. S. V. Iordanskiĭ (Steklov Inst. of Mathematics, Academy of Sciences, U.S.S.R.). Doklady Akad. Nauk S.S.S.R. 127, 509-12(1959) July 21. (In Russian)

A kinetic equation was developed for a single-dimensional, noninteracting plasma (the magnetic field is zero) where total electron and ion charge is zero. (R.V.J.)

20381

THE TEMPERATURE OF NITROGEN AND AIR BEHIND A SHOCK WAVE. F. S. Faizullov, N. N. Sobolev, and E. M. Kudryavtsev (Lebedev Inst. of Physics, Academy of Sciences, U.S.S.R.). Doklady Akad. Nauk S.S.S.R. 127, 541-4(1959) July 21. (In Russian)

Data on the temperature of air and nitrogen behind shock waves were previously derived by a generalized method of spectral conversion lines with photoelectric recording. An attempt is made to extend the photoelectric variation of spectral line conversion for determining temperature distribution along a shock wave. The shock wave velocity in a shock tube was studied by ionization methods and the temperature by the sodium D lines. The results showed that in studies using the generalized method of spectral line conversion, the best results can be obtained by using sodium D lines up to 3500°K and ion lines Ba 4554 A for measurements above 3500°K. Such a procedure avoids the distorting effect of a boundary layer. Moreover, in contrast to a photographic method, the use of wide slits is advised. (R.V.J.)

20382

DYNAMIC DISPLACEMENTS OF ATOMS AS RELATED TO LINEAR EXPANSION COEFFICIENTS IN ALUMINUM, GALLIUM AND INDIUM ARSENIDES. N. N. Sirota and Yu. I. Pashintsev (State Scientific Research and Project Inst. of Rare-Metal Industry). Doklady Akad. Nauk S.S.S.R. 127, 609-11(1959) July 21. (In Russian)

The relationship between atomic mean-square atomic displacement in crystalline lattices of semiconducting compounds of aluminum, gallium, and indium arsenides and their linear expansion coefficients was investigated. It was found that at 200 to 650°K the mean-square dynamic displacements are in direct proportion to the linear expansion coefficient squares. (R.V.J.)

20383

JOY-STICK CONTROL AIDS TELESCOPE TRACKING. Richard L. Shaum and D. W. Savage (Sandia Corp., Albuquerque, N. Mex.). Electronics 32, 87-89(1959) Apr. 24.

Aided tracking in this system is accomplished by replacing a simple rate signal with a composite of displacement, acceleration, and rate functions. Thus the operator only has to add corrections to a tracking vector if the tracking rate changes. The aided-tracking system is supplemented by a radar acquisition system which automatically positions the turret on a remote target. When the operator sees the target he takes control with the aided-tracking system. (auth)

20384

ON QUANTUM ELECTRODYNAMICS IN A MEDIUM. I. M. L. Ter-Mikayelyan. Izvest. Akad. Nauk Armyan. S.S.R. Ser. Fiz. Mat. Nauk 11, No. 4, 13-20(1958).

The influence of the dielectric and magnetic properties of a medium on radiation corrections was investigated. In the calculation of these corrections for the case of Coulomb dispersion, logarithmically divergent results are obtained. The results show that these compensations (continuous radiation) depend on the properties of the medium so that the magnitude of the radiation corrections also depends on the medium. For determination of the corrections the dispersion matrix in regard to the medium must be related. A partial solution of the problem is given. (TCO)

20385

ON THE GRAVITATION INSTABILITY OF A PLANE PARALLEL LAYER OF A CONDUCTING LIQUID IN A MAGNETIC FIELD. R. S. Oganesyan. Izvest. Akad. Nauk Armyan. S.S.R. Ser. Fiz. Mat. Nauk 11, No. 4, 39-52(1958).

The gravitational instability of an infinite plane parallel liquid layer with regard to transverse oscillations is examined. The layer is influenced by its own gravitational field and by a magnetic field vertical to the layer. Infinite conductivity of the medium is assumed. The solution of the problem is carried out according to the linear theory by the method of Chandrasekhar and Fermi. It is stated that, if the tension of the magnetic field exceeds a certain critical value, the layer is stable with regard to transverse oscillations of arbitrary length. Otherwise the layer becomes unstable and decomposes for sufficiently long oscillations. (auth)

20386

ELECTRON ENERGY SPECTRA IN IRON–CHROMIUM ALLOYS. N. D. Borisov, V. V. Nemoshkalenko, and A. M. Fefer (Inst. of Metal Physics, Academy of Sciences, Ukrainian S.S.R.). Izvest. Akad. Nauk S.S.S.R., Ser. Fiz. 23, 573-7(1959) May. (In Russian)

The fine structure of x-ray emission $K_{\beta 5}$ lines of chromium and iron was studied in Cr–Fe alloys containing 34, 45, and 55 wt. % Cr, annealed at 1150°C. (R.V.J.)

20387

CHROMIUM ABSORPTION K SPECTRA IN BORIDES, CARBIDES AND NITRIDES AND OTHER COMPOUNDS. S. A. Nemnonov and A. Z. Men'shikov. Izvest. Akad. Nauk S.S.S.R., Ser. Fiz. 23, 578-81(1959) May. (In Russian)

The nature of atomic interactions between the transitional group metals and metalloids of the first periodic group (B, C, N, and O) was investigated using CrB, CrB_2, Cr_3C_2, Cr_7C_3, Cr_2N, CrN, Cr_2O_3, and chemically pure $CrCl_3$ and $Cr_3(SO_4)_3$. The basic K-edge of Cr absorption in compounds and metallic chromium was plotted and analyzed. A well defined fine-edge structure expanding from 150 to 200 ev towards the short wave side (6 to 7 fluctuations) was found in all compounds except $CrCl_3$, Cr_2O_3, and $Cr_2(SO_4)_3$. (R.V.J.)

20388

ON THE MULTICOMPONENT ALLOY DIFFUSION SCATTERING OF X-RAYS AND SLOW NEUTRONS. V. V. Geĭchenko, V. M. Danilenko, M. A. Krivoglaz, Z. A. Matysina, and A. A. Smirnov (Inst. of Metal Physics, Academy of Sciences, Ukrain. S.S.R.). Izvest. Akad. Nauk S.S.S.R., Ser. Fiz. 23, 637-9(1959) May. (In Russian)

The wave scattering approximation generalized for solid solutions with various structures and having an arbitrary number of components in disordered states was derived. (R.V.J.)

20389

THE THEORY OF X-RAY AND THERMAL NEUTRON SCATTERING BY THE FLUCTUATION OF HETEROGENEOUS SOLID SOLUTIONS. M. A. Krivoglaz and E. A. Tikhonova (Inst. of Metal Physics, Academy of Sciences, Ukrainian S.S.R.). Izvest. Akad. Nauk S.S.S.R., Ser. Fiz. 23, 652-4(1959) May. (In Russian)

The intensity of monochromatic x rays and thermal neutron scattering by monocrystalline solid solutions was investigated within the limits of kinematic theory. Solutions of arbitrary composition with arbitrary removed and close order parameter magnitudes are analyzed. The calculations were made for binary and multicomponent solutions. The anisotropy and atomic structure of the crystal were considered in studies of distortions. (R.V.J.)

20390

MAGNETIC SUSCEPTIBILITY OF SOLIDS. J. A. Krumhansl (Oak Ridge National Lab., Tenn.). J. Appl. Phys. 30, 1183-6(1959) Aug.

The magnetic susceptibility of semiconductors depends on electronic properties of the lattice, on the motion of free carriers and on the presence of impurity states. Critical points in the work on Ge and Si are reviewed relative to demands they place on theoretical interpretations. Anomalies in the susceptibility of high-purity specimens, various aspects of valence band carrier susceptibility, and the susceptibility of acceptor states are not as yet explained satisfactorily. (auth)

20391

ELECTRONIC STRUCTURE OF LiH ION. O. Platas, R. P. Hurst, and F. A. Matsen (Univ. of Texas, Austin). J. Chem. Phys. 31, 501-3(1959) Aug.

A valence-bond calculation has been carried out for $(LiH)^+$ with all twenty structures possible from Slater orbitals 1s, 2s, 2p on lithium, and 1s(= 1h) orbital on hydrogen. The total electronic energy computed for the ion at the equilibrium distance for the LiH molecule is −209.50 ev with only the $1s^2 1h$ structure making a significant contribution to the ground state. When this energy is combined with the corresponding calculated energy for the molecule, a vertical ionization energy of 7.52 ev is obtained. No experimental value has as yet been reported. A technique is developed and is used to obtain the optimum orbital exponents for $1s^2 1h$ over a wide range of internuclear distance. This calculated energy vs. distance curve has no minimum suggesting that $(LiH)^+$ is unstable with respect to dissociation. At R = 3.08 au the wave function is "degenerate," that is, two different extremum sets of exponents yield the same energy. The principal difference is that the orbital exponent of the 1h function is 0.49 in one set and 1.04 in the other. At R > 3.08 au the second set gives the lowest energy while the reverse is true for R < 3.08 au. This is interpreted as representing the promotion 1s → 2s as is required in approaching the united atom. (auth)

20392

THOMAS-FERMI MODEL OF POSITIVE ION. Shigehiro Kobayashi (Kagawa Univ., Takamatsu, Japan). J. Phys. Soc. Japan 14, 1039-54(1959) Aug.

Exact solutions of the Thomas-Fermi equation for a positive ion have been obtained including their derivatives by the inward numerical integration. The whole range of the ionization degree of physical interest has been covered in sufficient detail to permit accurate interpolation for intermediate regions. Using these numerical solutions, several physical quantities of free positive ions have been investigated. (auth)

20393

FINE STRUCTURE IN THE GIANT RESONANCE FOR Cu^{63} AND $Ag^{107}(\gamma,n)$ REACTIONS. Teruo Nakamura, Kiyoji Funkunaga, Kunio Takamatsu, Minoru Yata, and Shinjiro Yasumi (Kyoto Univ.). J. Phys. Soc. Japan 14, 1117-18(1959) Aug.

Utilizing the energy variation of $Li(p,\gamma)$ radiation by the Doppler effect, the Cu^{63} and $Ag^{107}(\gamma,n)$ reactions were investigated for the existence of fine structure. It was concluded that in $Cu^{63}(\gamma,n)$ reaction there was no fine level larger than 0.2 Mev-mb, while in $Ag^{107}(\gamma,n)$ reaction there was no fine level larger than 0.7 Mev-mb. (C.J.G.)

20394

ON THE PROBLEM OF EXPERIMENTAL DETERMINATION OF THE DROP SIZE DURING INVESTIGATIONS OF EXTRACTION COLUMNS WITH FILTER PLATES. A. N. Planovskii and S. N. Bulatov. Nauch. Doklady Vysshei Shkoly Khim. i Khim. Tekhnol. No. 4, 804-9(1958).

For an investigation of the hydrodynamic conditions while working on extraction columns with filter plates and for the determination of the equivalent drop size diameter, the electromechanical and the oscillograph methods are suggested. For determining the drop size according to the electromechanical method, a special apparatus was used, the scheme of which is given. The apparatus is suitable for determining the drop size under constant and varying frequency of the drop formation to a frequency range of 20 to 25 cycles. For the calculation of the equivalent diameter of the drops, a formula is suggested. The oscillograph method permits an exact determination of the drop size, period of drop formation, equivalent diameter of drops, and the frequency of the drop formation. Formulas are suggested for use with the method. (auth)

20395

AN ACCURATE PHOTO-NEUTRON STANDARD. P. C. Marin (Laboratoire de l'Ecole Normale Supérieure, Paris). Nuclear Instr. and Methods 5, 26-36(1959) July.

An easily reproducible, RdTh-D_2O, photo-neutron standard was built. Its calibration is based on the associated charged particle method. Its photoneutron yield was determined to an accuracy of 1.1%. After calibration, the ionization current of the RdTh source was compared to the ionization current of a standard radium source, on a Curie chamber. The yield of any substandard can be determined, apart from small geometrical corrections, by a simple comparison of the RdTh source to the radium standard on the Curie chamber. Background neutrons from (α,n) reactions in the RdTh source contribute to 3% of the total yield. The number of neutrons emitted by the source used was determined by the recoil proton method, using an ionization chamber and by chemical integration in a manganese nitrate solution. The total yield of the standard is known to an accuracy of 1.25%. (auth)

20396

MEASUREMENT OF THE RISE TIME OF ELECTRIC PULSES LESS THAN A MILLIMICROSECOND. A. Sarazin, J. Samueli, and G. Ducros (Institut d'Etudes

Nucléaires, Alger, Algeria). Nuclear Instr. and Methods 5, 44-9(1959) July. (In French)

A system based on time-pulse height conversion is described, which enables electrical pulse rise times of less than one millimicrosecond and their statistical fluctuations to be measured, in the range from 0 to 5×10^{-9} sec. The method was used to study pulses from a mercury switch and from scintillations in a plastic scintillator or gas induced by ionizing radiations. (auth)

20397

INVESTIGATION ON QUANTUM ELECTRODYNAMICS AT SHORT DISTANCES BY MEANS OF BREMSSTRAHLUNG AND PAIR PRODUCTION. G. Poiani and I. Reina (Universita, Trieste, Italy and Istituto Nazionale di Fisica Nucleare, Trieste, Italy). Nuovo cimento (10) 13, 19-26(1959) July 1.

By means of a study of bremsstrahlung and pair production the possibility is examined of extending the limits of the validity of electrodynamics to values beyond those at present known. For this purpose the cross sections for these two processes are calculated by introducing a covariant function which takes account of the form factors relative to the electrodynamic vertices. These calculations are then applied to some cases of experimental tests which would be more sensitive to the limits of electrodynamics. (auth)

20398

IRREDUCIBILITY CONSTRAINTS AND FIELD EQUATIONS FOR THE ELEMENTARY PARTICLES. II. FERMIONS. G. C. Bollini (Imperial Coll. of Science and Tech., London). Nuovo cimento (10) 13, 46-56 (1959) July 1.

The conditions needed to describe an elementary particle by an irreducible quantity in the Lorentz group are taken as constraint equations to be imposed on the field entity. The independent components are extracted in a covariant way. The field equations are deduced from a Lagrangian in which only the free components are permitted to be varied. The communication relations, compatible with the constraints, are also given. Spin-tensors and simple Dirac spinors are considered for which second order equations are proposed. A brief and unifying treatment for elementary particles of any spin is given. (auth)

20399

THE ATTENUATION LENGTH OF THE HIGH ENERGY NUCLEONIC COMPONENT OF THE COSMIC RADIATION NEAR SEA LEVEL. K. G. McCracken (Univ. of Tasmania, Hobart, Australia) and D. H. Johns (Dept. of External Affairs, Melbourne). Nuovo cimento (10) 13, 96-107(1959) July 1.

From the analysis of neutron data obtained at two widely separated stations, it is shown that during 1957 the attenuation length of the high energy nucleonic component of the cosmic radiation near sea level was 138.1 ± 0.8 g/cm^2 at high geomagnetic latitudes. Analysis of data from a number of stations shows that the amplitudes of Forbush type decreases increase by about 12% per 1000 m increase in station altitude. This is taken as evidence that the value of the attenuation length is sensitive to changes in the rigidity spectrum of the primary radiation, becoming greater as the primary cosmic ray spectrum hardens. It is shown that at sea level near the equator the attenuation length is considerably greater than at high latitudes, having a value of about 159 g/cm^{-2}. It is shown that the correction for atmospheric change can be the limiting factor in the study of small time variations in the primary intensity by means of a measurement of the nucleonic component deep in the atmosphere. (auth)

20400

ON THE DESCRIPTION OF UNSTABLE PARTICLES IN QUANTUM FIELD THEORY. M. Lévy (Université, Paris). Nuovo cimento (10) 13, 115-43(1959) July 1.

The mass and life time of an unstable particle may be defined by the real and imaginary parts of a complex pole appearing on the Riemann surface in which its propagator can be continued analytically. This method, which was originally proposed by Peierls, is studied in detail, first on the basis of a special model, then in a more general field theory. The possibility of analytical continuation of the propagator is discussed, using the conditions of causality and unitarity of the S-matrix. The appearance of unphysical poles in the various sheets of the Riemann surface is also discussed. It is inferred that a physical principle must be used in each case, in order to select the particular pole which can be correctly interpreted as describing the properties of an unstable particle. (auth)

20401

GEOMETRICAL GENERALIZATION OF γ_5-INVARIANCE. S. Watanabe (I.B.M. Research Lab., Yorktown Heights, N.Y.). Nuovo cimento (10) 13, 144-7(1959) July 1.

It is shown that all the free Lagrangians and the well-established strong, intermediate, and weak interaction Lagrangians are invariant for a special transformation which has a simple geometrical meaning and is a natural generalization of the γ_5-transformation. This invariance with certain further requirements can limit the possible interaction types to a very small number. (auth)

20402

THE DIFFUSION COEFFICIENT IN DILUTE H_2-D_2 AND $^3He-^4He$ LIQUID MIXTURES. G. Careri, J. Reuss, and J. M. Beenakker (Laboratori Nazionali dell' I.N.F.N., Frascati, Italy and Kamerling Onnes Laboratorium, Leiden.). Nuovo cimento (10) 13, 148-53(1959) July 1.

An apparatus was built to measure the diffusion coefficient in liquids at very low temperatures. This technique was applied to the hydrogen–deuterium dilute mixtures, and the results can be expressed by an Arrhenius type equation as function of the absolute temperature $D = 64 \exp[48/T] \cdot 10^{-5}$ cm^2/s. The same technique was more difficult to use for the helium isotope mixtures. The results are affected by large errors and roughly $D = (4 \pm 2) \times 10^{-5}$ cm^2/s in the temperature range above the λ point. (auth)

20403

LIMITATIONS ON THE NUCLEON FORM FACTORS DUE TO CAUSALITY REQUIREMENTS. B. Bosco and V. De Alfaro (Università, Turin and Instituto Nazionale di Fisica Nucleare, Turin). Nuovo cimento (10) 13, 154-8(1959) July 1.

Starting from the spectral representation of the form factors, an investigation of the kind of functions to be used in representing the nucleon charge and magnetic moment distributions in configuration space is presented. (auth)

20404

ON PARITY CONSERVATION IN STRONG INTERACTIONS. N. Dallaporta (Universita, Padua and Instituto Nazionale di Fisica Nucleare, Padua). Nuovo cimento (10) 13, 159-72(1959) July 1.

The analogy in respect to γ_5 invariance between the two-component Dirac equation for the neutrino and the

Schremp-Gürsey type equation describing bayrons is used in order to express the lagrangian for strong interactions as the sum of two types of parity non-conserving terms formally similar to those adopted for weak interactions. These terms, however, when suitably grouped, may be shown to compensate each other in order that parity is always conserved and the conventional lagrangian is obtained; the compensation is a consequence of the fact that the number and disposition of the baryon states in the elementary particle scheme is such as to allow this grouping of compensating pairs; the original asymmetry remains only detectable in the mass differences between baryons which may naturally be thus interpreted as a consequence of it. (auth)

20405

SPIN-LATTICE RELAXATION TIME IN LIQUID ^{3}He. G. Careri, I. Modena, and M. Santini (Università, Padua and Istituto Nazionale di Fisica Nucleare, Padua). Nuovo cimento (10) 13, 207-12(1959) July 1.

The spin-lattice relaxation time T_1 was measured in liquid He^3 from 1.1 to 3°K at its saturated pressure. The results indicated a sharp increase of T_1 decreasing the temperature below 1.4°K. This behavior cannot be accounted for by the Bloembergen, Purcell, and Pound theory. (auth)

20406

POSSIBLE EXAMPLE OF AN INTERACTION IN EMULSION PRODUCED BY A DEUTERON OF ~10^{13} ev. P. K. Aditya (Panjab Univ., Chandigarh, India). Nuovo cimento (10) 13, 219-23(1959) July 1.

The characteristics of neutron interactions observed as secondary events in high-energy showers are interpreted as being due to the proton and neutron of ~10^{13} ev. An approximate estimate of the proportion of deuteron interactions at very high altitudes is given. (C.J.G.)

20407

WAVE OPERATORS IN MULTICHANNEL SCATTERING. M. N. Hack (Argonne National Lab., Lemont, Ill.). Nuovo cimento (10) 13, 231-6(1959) July 1.

Some important consequences of, and conditions for, the convergence to the wave operators in the case of multichannel scattering are derived. The convergence for the typical multichannel systems with quadratically integrable interactions is demonstrated. (C.J.G.)

20408

A NEW METHOD FOR THE DETERMINATION OF THE MESON-NUCLEON COUPLING CONSTANT FROM THE 33 PHASE SHIFT. A. Martin (CERN, Geneva). Nuovo cimento (10) 13, 241-3(1959) July 1.

The proposed method is free of assumptions on the energy dependence of the phase shift, requiring only that in the low-energy region the cut-off factor be taken as unity. (D.E.B.)

20409

ION CONFINEMENT BY ROTATION IN MAGNETIC MIRROR GEOMETRY. C. L. Longmire, D. E. Nagle, and F. L. Ribe (Los Alamos Scientific Lab., N. Mex.). Phys Rev. 114, 1187-91(1959) June 1.

When a generally radial electric field is imposed upon a mirror magnetic field configuration, the resulting system has an increased ability to contain plasma between the mirror regions. The motion of the ions consists of a drift around the axis of symmetry upon which is superimposed a spiraling motion. The guiding center motion departs from the direction of magnetic flux surfaces. An adiabatic invariant is derived for the drift component of the motion, and an expression is derived for the mirror enhancement brought about by the E × B drift. The departure of the guiding center of a particle from a flux surface and the energy balance of its secular motion are calculated by using the adiabatic invariant. (auth)

20410

BEHAVIOR OF INTENSE RELATIVISTIC ELECTRON BEAMS. Richard H. Capps (Univ. of Washington, Seattle). Phys. Rev. 114, 1203-17(1959) June 1.

A theoretical investigation is made of intense, relativistic, partially neutralized, self-focusing electron beams. Approximate equations are derived that express the time derivatives of the beam radius and mean electron energy as functions of these parameters, the densities of the electrons, ions, and neutral atoms, and the impressed electric and magnetic fields. The equations are numerically integrated for various values of the parameters. It is shown that the radiation damping leads to a shrinkage of the beam radius to a value of order 0.05 mm in a time of order 10^{-2} to 10^{-1} second. If the longitudinal electric field is constant the beam approaches the "equilibrium state" discussed by Budker, in which the increase in electron transverse momentum caused by scattering from the ions is compensated by radiative loss, and the energy lost by radiation is restored by the longitudinal field. (auth)

20411

TRIDENTS, μ PAIRS, AND QUANTUM ELECTRODYNAMICS AT SMALL DISTANCES. J. D. Bjorken and S. D. Drell (Stanford Univ., Calif.). Phys. Rev. 114, 1368-74(1959) June 1.

Four experiments are proposed and discussed as tests of quantum electrodynamics, as applied to photons, electrons, and μ mesons at distances $<10^{-13}$ cm. These are: electron-positron pair production by electrons in hydrogen (tridents); wide-angle photoproduction of μ-meson pairs in hydrogen with detection of one final meson; wide-angle photoproduction of μ-meson pairs in hydrogen with detection of both final mesons in coincidence; μ-meson pair-production by electrons in hydrogen. Taken together with wide-angle photoproduction of electron-positron pairs, which was discussed earlier, these experiments will extend our knowledge of electron, photon, and μ-meson "size" to distances ~0.3×10^{-13} cm. They are all feasible for the Stanford linear accelerator operating in the 500 Mev-1 Bev energy range. (auth)

20412

TRAVELING WAVE FOCUSING FOR PLASMA CONTAINMENT. C. K. Birdsall and Allan J. Lichtenberg (Univ. of California, Berkeley). Phys. Rev. Letters 3, 163-4(1959) Aug. 15.

Two experiments were performed with plasma columns extending through slow wave structures 3 and 23 cm long. In both cases the diameter of the plasma column was 0.75 cm. Focusing was tried in the frequency range of 3 to 25 Mc/sec and at 1000 Mc/sec. In the low-frequency range a column of tens of milliamperes discharge could be focused by some tens of watts of power at all frequencies. The amount of contraction of the plasma appeared proportional to the applied power over the entire frequency range. (W.D.M.)

20413

CONSIDERATIONS ON THE INTERACTIONS BETWEEN THERMAL VACANCIES AND DISLOCATIONS. H. G. F. Wilsdorf (Franklin Inst. Labs., Philadelphia) and D. Kuhlmann-Wilsdorf (Univ. of Pennsylvania, Phila-

delphia). Phys. Rev. Letters 3, 170-2(1959) Aug. 15.

Recently a study was made of the behavior of thin aluminum foils containing quenched-in dislocation loops while being strained in the electron microscope. In an effort to determine what influence, if any, specimen size has on the previously observed phenomena, quenched aluminum was deformed approximately 2% before thinning it into electron-transparent foils. The result was that, instead of the smooth dislocation lines, intricate tangles of kinked and branching dislocations with interspersed loops were found, whereby the loop density seemed to be somewhat smaller than in the as-quenched specimens. (W.D.M.)

20414

CAUSE OF THE MINIMUM IN THE EARTH'S RADIATION BELT. S. F. Singer (Univ. of Maryland, College Park). Phys. Rev. Letters 3, 188-90(1959) Aug. 15.

It has been argued that both radiation belts (1.5 and 3 to 4 earth radii) may be of solar origin with the minimum at $2R_E$ due to some other cause. In order to decide among the various possibilities on the cause of the minimum, the expected altitude dependence of the cosmic-ray belt was calculated by incorporating in more detail the breakdown of the adiabatic condition. (W.D.M.)

20415

ON THE THEORY OF LINEARIZED PROBLEMS IN DETONATION WITH COUNTERIMPACT. V. P. Korobeinikov and E. V. Ryazanov. Priklad. Mat. i Mekhan. 23, 749-59(1959) July-Aug. (In Russian)

20416

MICROSCOPIC TESTS OF SYMMETRY PRINCIPLES. G. Feinberg and M. Goldhaber (Brookhaven National Lab., Upton, N. Y.). Proc. Natl. Acad. Sci. U. S. 45, 1301-12(1959) Aug.

A collection of experiments which put rather stringent limits on possible violations of conservation laws and related symmetry principles, those which are believed to be universally valid. The evidence for the absolute conservation laws connected with gauge transformations, i.e., the conservation of charge, of baryons, and of leptons is discussed. Discussion is presented on the evidence for the equality of the charges of the various charged elementary particles, and evidence for the conservation of angular momentum, associated with symmetry under space rotations. (C.J.G.)

20417

STRATOSPHERIC CARBON-14, CARBON DIOXIDE, AND TRITIUM. French Hagemann, James Gray, Jr., Lester Machta, and Anthony Turkevich. Science 130, 542-52(1959) Sept. 4.

The results of measurements made in recent years of the C^{14}, CO_2, and tritium in the stratosphere are presented. The purpose of the measurements was to obtain information on the stratospheric concentrations of C^{14} and tritium produced by the explosion of nuclear devices and to study the changes in these concentrations with time. (W.L.H.)

20418

THE THERMAL CIRCUIT OF A ONCE-THROUGH BOILER-TURBINE UNIT. B. I. Shmukler. Teploenergetika No. 3, 8-15(1959).

In order to reduce heat losses, it is important to be able to start up a once-through boiler with gradually increasing steam output corresponding to the turbine requirements. The difficulty is to maintain steady flow conditions in the boiler while the turbine is being started. This difficulty prompted the development of a special separator circuit for starting-up. The circuit uses a start-up device which separates the evaporative and superheater parts of the boiler. By this means the appropriate flow of water can be maintained in the evaporative part with gradually increasing flow through the superheater. The principles of operation of the arrangement are described. One variation of the thermal circuit allows the boiler and turbine to be started up simultaneously. It is calculated that simultaneous starting of the given turbine and boiler in this way economizes about 500 tons of conventional fuel per start. Using another variation of the thermal circuit, a schematic diagram of which is given, the set can be kept in service during sudden load changes. The additional equipment required for this purpose is described. The method of operation is explained. Although the second circuit permits the set to run even at no-load, such flexibility is rarely necessary. It was recommended that the simplified thermal circuit for the first sets be installed in large power systems. Test results illustrating a sudden stop and restart of an experimental boiler are plotted graphically. (TCO)

20419

EXPERIENCE IN DEVELOPING THE BLADING FOR THE LAST STAGE OF A 150-MW TURBINE. S. P. Sobolev, A. Ye. Shneydman, N. Ya. Zel'des, V. P. Sukhinin, and L. A. Shor. Teploenergetika No. 3, 26-9 (1959).

Design of last-stage blading for large turbines is described. All the blades in the series are designed on common principles and are standardized as much as possible. The main aerodynamic characteristics of the blade are tabulated. Successive stages in profiling of the blade are described. The blading was made of stainless chrome steel since the stress levels conform to its properties. The stress distribution over the length of the blade is plotted. The method of assembling the blading in the wheel is described and illustrated photographically. The blades are made from forgings each weighing 35 kg. The fabrication method is described, and the manufacture of larger blades is considered possible. (TCO)

20420

TEMPERATURE DISTRIBUTION IN A GAS-TURBINE ROTOR. Ye. I. Molchanov. Teploenergetika No. 3, 30-1(1959).

A 1500-kw gas turbine was used for the measurements. The initial gas temperature was 600°C. The turbine rotor is of the solid-forged drum type and is made of austenitic steel. The turbine speed is 5,000 rpm. Temperature measurements were taken in the bore of the rotor by means of chromel-alumel thermocouples installed at various points. Measurements were made every five minutes while the rotor was being heated up, and at longer time intervals thereafter. Temperature changes at various parts of the rotor bore as a function of time are plotted. A graph of the temperature distribution in the rotor bore during steady thermal conditions is given. Equilibrium is reached about four hours after starting. The results show that the rotor is strongly heated and that temperature gradients appear. Thermal expansion of the rotor is considerable but is less than the expansion of the turbine casing. (TCO)

20421

A NEW HIGH-EFFICIENCY COMPRESSOR STAGE

WITH 50% DEGREE OF REACTION. G. A. Sergeyev. Teploenergetika No. 3, 32-5(1959).

Characteristics of a high-efficiency compressor stage are given. An expression is written for the distribution of the discharge component of the velocity over the blade radius. Curves of this velocity distribution and of the inflow angles for the stage are given. The main stages of the design are described. Wind tunnel tests were made on individual blades. The stage as a whole was tested on a single-stage axial compressor rig. Test results on the completed blading are presented graphically. The maximum efficiency of the stage occurs at a peripheral velocity of 150 to 200 m/sec and is rated at approximately 95%. It is concluded that the stage can be used in the construction of multi-stage high-efficiency axial compressors. (TCO)

20422

RADIATIVE RECOMBINATION IN SEMICONDUCTORS. V. S. Vavilov. Uspekhi Fiz. Nauk 68, 247-60(1959) June. (In Russian)

A review is presented of the theoretical conception on radiative recombination in semiconductors, and the results of experiments carried out up to the end of 1958 are described. (R.V.J.)

20423

SUPER LIGHT SPEED PARTICLE RADIATION AND SOME APPLICATIONS OF THE RADIATION IN EXPERIMENTAL PHYSICS. P. A. Cherenkov. Uspekhi Fiz. Nauk 68, 377-86(1959) July. (In Russian)

Developments and applications of relativistic particle radiation in experimental physics are described in a lecture presented at the Nobel Prize presentation Dec. 11, 1958, in Stockholm. (R.V.J.)

20424

GENERAL PROPERTIES OF RADIATION EMITTED BY SUPER LIGHT SPEED SYSTEMS AND THEIR APPLICATIONS IN PLASMA PHYSICS. I. E. Tamm. Uspekhi Fiz. Nauk 68, 387-96(1959) July. (In Russian)

The general properties of radiation emitted by relativistic systems and some application of the phenomena in plasma physics are reviewed. (R.V.J.)

20425

OPTICS OF LIGHT SOURCES MOVING IN REFRACTIVE MEDIA. I. A. Frank. Uspekhi Fiz. Nauk 68, 397-415(1959) July. (In Russian)

Problems of Cherenkov–Vavilov radiation related to emissions from light sources in motion in refractive media are analyzed. (R.V.J.)

20426

PHYSICAL STUDIES OF GASES BY MEANS OF SHOCK WAVES. R. I. Soloykhin. Uspekhi Fiz. Nauk 68, 513-28(1959) July. (In Russian)

A study was made of the thermodynamic equilibrium behind shock waves in various gases. The selection of the method for preparing and utilizing the shock waves, the thermodynamic properties of air and other gases at high temperature, the propagation of shock waves in relaxing gas, and the chemical reactions in gases behind the shock waves are discussed. Spectroscopic studies were made of the gas behind the shock waves. 52 references. (R.V.J.)

20427

EFFECTS OF VISCOSITY AND HEAT CONDUCTIVITY ON THE GAS FLOW BEHIND A DISTORTED SHOCK WAVE. G. A. Lyubimov. Vestnik Moskov. Univ. Ser. Mat., Mekhan., Astron., Fiz. i Khim. 13, No. 5, 33-5 (1958). (In Russian)

Formulas are derived for determining the temperatures and impact relations in front and behind arbitrarily shaped shock waves, considering the viscosity and heat conductivity of the gas. (R.V.J.)

20428

OPTIC STUDIES OF POWERFUL PULSE DISCHARGE IN HYDROGEN. P. S. Kireev and A. A. Yuzefovich. Vestnik Moskov. Univ. Ser. Mat., Mekhan., Astron., Fiz. i Khim. 13, No. 5, 105-10(1958). (In Russian)

Results are presented from optical studies of plasmic gas discharge in hydrogen with long-duration pulses (500 μ sec). (R.V.J.)

20429

A MAGNETIC TRAP WITH A FIELD INCREASING TOWARDS THE PERIPHERY. S. Yu. Luk'yanov and I. M. Podgorny. Zhur. Eksptl'. i Teoret. Fiz. 37, 27-32(1959) July. (In Russian)

Results of an investigation of the behavior of a plasma produced by an electron beam are presented. The strength of the magnetic field of the trap increases toward the periphery. (auth)

20430

PHASE DIAGRAM OF LIQUID He^3–He^4 SOLUTIONS. K. N. Kinov'eva and V. P. Peshkov (Inst. of Physical Problems, Academy of Sciences, S.S.S.R.). Zhur. Eksptl'. i Teoret. Fiz. 37, 33-7(1959) July. (In Russian).

It is established that the critical point for phase separation in He^3–He^4 mixtures is T = 0.88°K and x = 64% molar He^3 concentration. At the point T = 0.67 K and x = 82% the λ line intersects the phase separation line. Above this temperature both phases are superfluid and below it the He^3-rich phase is not superfluid. (auth)

20431

ON THE STABILITY OF A HOLLOW GAS CONDUCTOR IN A MAGNETIC FIELD. L. M. Kovrizhnykh Lebedev Inst. of Physics, Academy of Sciences, S.S.S.R.). Zhur. Eksptl'. i Teoret. Fiz. 37, 92-4(1959) July. (In Russian)

Stability conditions are obtained for a hollow gaseous conductor located in a longitudinal magnetic field. (auth)

20432

RESONANCE CHARGE EXCHANGE OF DOUBLY CHARGED IONS IN SLOW COLLISIONS. I. K. Fetisov and O. B. Firsov. Zhur. Eksptl'. i Teoret. Fiz. 37, 95-7(1959) July. (In Russian)

The cross section for resonance charge exchange of doubly charged ions is computed in the adiabatic approximation. The experimental and theoretical cross sections for charge exchange of doubly charged positive Ar, Ne, Kr, and Xe ions are compared. (auth)

20433

RANGE–ENERGY RELATION FOR VARIOUS SUBSTANCES. M. Z. Maksimov. Zhur. Eksptl'. i Teoret. Fiz. 37, 127-30(1959) July. (In Russian)

On the basis of an analysis of the experimental and theoretical data on stopping of charged particles in matter, it is concluded that the specific losses and the range depend only on the ratio E_a/a, that is, of the energy of the incident particle per nucleon to the mean excitation potential of the atoms of the medium. Proceeding from this assumption a universal experimental curve is plotted on the basis of the experimental data which yields the range for energies lying in the interval $0.5 \leq E_a/a \leq 200$ Mev for any substance, providing the excitation potential of the latter is known. (auth)

20434

THEORY OF WEAK SOLUTIONS OF He^4 IN LIQUID He^3. V. N. Zharkov and V. P. Silin (Inst. of Physics of the Earth, S.S.S.R.). Zhur. Eksptl'. i Teoret. Fiz. 37, 143-53(1959) July. (In Russian)

A weak solution of He^4 in liquid He^3 is considered as a Boltzmann gas of impurity excitations (associated with the He^4 atoms) in a Fermi fluid. The spectrum of the impurity excitations and the thermodynamics of the solution are examined. Kinetic equations for Fermi and impurity excitations of the solution were derived. The dependence of the diffusion, thermodiffusion, viscosity, and thermal conductivity coefficients on temperature and concentration were determined. (auth)

20435

ON RADIATIVE PROCESSES IN FRONT OF A SHOCK WAVE. L. M. Biberman and B. A. Veklenko (Moscow Inst. of Energetics). Zhur. Eksptl'. i Teoret. Fiz. 37, 164-9(1959) July. (In Russian)

The distribution of excited atoms or molecules in front of a shock wave is considered. Excitation is caused by the radiation emitted from the front of the wave. Nonstationary diffusion of the radiation is taken into account. It is shown that concentrations of excited atoms or molecules corresponding to an excitation temperature close to the temperature of the wave appear in the cold gas in front of the wave. (auth)

20436

ACCOUNT OF COULOMB EFFECTS IN SUPERCONDUCTIVITY. D. V. Shirkov (Joint Inst. of Nuclear Studies, Dubna, U.S.S.R.). Zhur. Eksptl'. i Teoret. Fiz. 37, 179-86(1959) July. (In Russian)

The compensation equation for dangerous electron graphs is reduced to a symmetrical form expressed in terms of the conventional Green functions by changing from the energy operator to the S-matrix. Summation of coulomb singularities in the kernel of the compensation equation is carried out in the strongly compressed electron gas approximation by the renormalization group method. In the lowest approximation the result of summation coincides with the formulas previously obtained by qualitative arguments. (auth)

20437

ON CONVECTIVE MOTION OF A CONDUCTING FLUID BETWEEN PARALLEL VERTICAL PLATES IN A MAGNETIC FIELD. S. A. Regirer (Northern Branch of the Inst. of Perma Frost, Academy of Sciences, S.S.S.R.). Zhur. Eksptl'. i Teoret. Fiz. 37, 212-16 (1959) July. (In Russian)

Stationary convective motion of a conducting fluid between vertical parallel plates in a magnetic field is considered. An exact solution of magnetohydrodynamic equations is obtained for the case of constant vertical temperature gradient. The critical value of Grasshof's number is determined for the case of equal temperatures of plates. (auth)

20438

CONTRIBUTION TO THE THEORY OF SPIN-LATTICE RELAXATION OF NUCLEAR SPINS IN IONIC CRYSTALS. B. I. Kochelaev. Zhur. Eksptl'. i Teoret. Fiz. 37, 242-8(1959) July. (In Russian)

Relaxation of nuclear spins in ionic crystals at room temperature is examined theoretically with a consideration of optical vibrations of the crystal lattice. Numerical calculations are carried out for NaCl type lattices. The agreement with the experimental data is satisfactory. (auth)

20439

PARAMAGNETIC RESONANCE IN POTASSIUM OZONIDE. A. K. Piskunov, A. A. Manenkov, and Z. A. Bagdasar'yan (Karpov Inst. of Physics and Chemistry). Zhur. Eksptl'. i Teoret. Fiz. 37, 302-4(1959) July. (In Russian)

An electron paramagnetic resonance method was used in an investigation of potassium ozonide paramagnetism. Paramagnetic resonance was studied in polycrystalline specimens containing ~90% KO_3 at 2580, 9375, 12,000, and 37,000 cm Hg at room temperature and at liquid nitrogen temperature. (R.V.J.)

20440

HYDRODYNAMICS OF FOREIGN PARTICLE SOLUTIONS IN HELIUM II AT λ-POINT. D. G. Sanikidze (Inst. of Physics, Academy of Sciences, Georgian S.S.R.). Zhur. Eksptl'. i Teoret. Fiz. 37, 320-1(1959) July. (In Russian)

Hydrodynamic formulas were developed for foreign particle solutions in helium II at the λ point. Concrete applications of the theoretical data demand a determination of the function $\epsilon(\rho, S, \rho_s, c)$ which can be derived by estimating the density and dependence of the He^3-H^4 superfluid component near λ on the p, T, and c. (R.V.J.)

20441

INDIRECT METHOD OF EVALUATING THE WIDTH OF THE REACTION ZONE IN A DETONATION WAVE. L. N. Stesik and L. N. Akimova (Inst. of Chemical Physics, Academy of Sciences, Moscow). Zhur. Fiz. Khim. 33, 1762-8(1959) Aug. (In Russian)

An experimental curve was plotted for determining the width of the reaction zone in a detonation wave from the relation between the detonation rate and the radius of the blasting charge. The width of the zone and the duration of the chemical reaction was determined in trotyl charges of various densities in hexogen and in various mixtures of trotyl and hexogen. (auth)

20442

THE EFFECT OF IODIDE ON THE PROPERTIES OF AN ESPECIALLY FINE-GRAINED NUCLEAR EMULSION. N. R. Novikova. Zhur. Nauch. i Priklad. Fot. i Kinematografii 4, No. 1, 49-55(1959).

The effect of iodide on scattering, light sensitivity, and sensitivity toward electrons and α particles in fine-grained nuclear emulsions were investigated. The effect of iodide on the light sensitivity and the sensitivity to α particles in non-sensitized nuclear emulsions is analogous to its effect on the light sensitivity of photographic emulsions. The effect of iodide on sensitivity to electrons is negative. Increased concentration of silver iodide in the emulsion decreases its ability of being sensitized by gold to the same degree. Increased concentration of surplus Ag ions makes the degree of scattering grow to a determined maximum, and decrease after this maximum has been reached, despite a further increase of the concentration. (TCO)

20443

AN INTERNATIONAL COLLOQUY ON NUCLEAR PHOTOGRAPHY. K. S. Bogomolov. Zhur. Nauch. i Priklad. Fot. i Kinematografii 4, No. 2, 152-7(1959).

An account of the 2nd International Colloquy on Nuclear Photography held in Montreal (Canada) on August 25–29, 1958, is presented. Reports of photographic emulsion improvement were of especial interest. They were devoted to questions connected with the hypersensitization of nuclear photographic materials. Type R (NIKFI) photographic layers, raised by hyper-

sensitization to a density number of 100 grains to 100 μ in a trace of a relativistic particle, were demonstrated under a microscope. The highest sensitivity achieved for an emulsion was with 60 grains to 100 μ by sensitization with gold, followed by hypersensitization with triethanolamine. Methods of improving the physicomechanical properties and stability of photoemulsion layers for nuclear experiments were examined. The superiority of the method of preparing nuclear emulsions by using strong dilutions in the first maturing and deposition of the hard phase was discussed. Numerous other papers on this subject are summarized. (auth)

20444

NEUTRON ENERGY SPECTRUM CALCULATIONS IN REACTOR SHIELDS. Presented at Nuclear Engineering and Science Conference, April 6-9, 1959, Public Auditorium, Cleveland, Ohio. Preprint V-84. James W. Haffner (General Electric Co., Evendale, Ohio). New York, Engineers Joint Council, 1959. 22p. $0.50.

A method is presented for calculating neutron energy spectra and related quantities in reactor shields. The method involves a combination of the point-to-point attenuation kernel (used in shielding analysis) and a multigroup P or S approximation (as used in reactor analysis). Comparisons between quantities calculated by use of this method and experimented measurements are presented. (auth)

20445

EFFICIENCY OF SOME BIASED SAMPLING SCHEMES IN MONTE CARLO CALCULATIONS. Presented at Nuclear Engineering and Science Conference, April 6-9, 1959, Public Auditorium, Cleveland, Ohio. Preprint V-130. J. F. Perkins and M. O. Burrell (Lockheed Nuclear Products, Marietta, Ga.). New York, Engineers Joint Council, 1959. 7p. $0.50.

Monte Carlo calculations of gamma-ray penetration of thick slabs were performed by using statistical estimation of the escape after each collision in conjunction with either the exponential transformation or the modified form. The efficiency and reliability of these schemes, the simplicity of which makes them particularly suitable for use, were examined for a variety of energies of incident photons and compositions and thicknesses of shielding slabs. The two biasing methods are of nearly equal efficiency and lead to standard errors of 10 to 30 percent for penetrations of up to 20 mean free paths when a sample size of 250 incident photons is employed. Sample estimates of error are subject to noticeable fluctuations for this sample size, but they seem to be a reliable guide in assigning confidence limits to calculated values of transmission. (auth)

20446

SOLID STATE PHYSICS. VOLUME 4. ADVANCES IN RESEARCH AND APPLICATIONS. Frederick Seitz and David Turnbull, eds. New York, Academic Press, Inc., 1957. 549p.

Research activity is presented of solid state physics on ferroelectrics and antiferroelectrics, mobility of electrons in solids, orthogonalized plane-wave method, bibliography of atomic wave functions, and techniques of zone melting and crystal growing. (W.D.M.)

20447

SOLID STATE PHYSICS. VOLUME 6. ADVANCES IN RESEARCH AND APPLICATIONS. Frederick Seitz and David Turnbull, eds New York, Academic Press, Inc., 1958. 438p.

Articles are presented on compression of solids by strong shock waves, changes of state of simple solid and liquid metals, electroluminescence, macroscopic symmetry and properties of crystals, secondary electron emission, optical properties of metals, and optical properties of impurities in nonmetals. (W.D.M)

20448

SOLID STATE PHYSICS. VOLUME 7. ADVANCES IN RESEARCH AND APPLICATIONS. Frederick Seitz and David Turnbull, eds. New York, Academic Press, Inc., 1958. 535p.

Articles are presented on thermal conductivity and lattice vibrational modes, electron energy bands in solids, the elastic constants of crystals, wave packets and electron transport in metals, new tools for surface studies, and structures of crystals. (W.D.M.)

20449

PRIMENENIYE YADERNYKH IZLUCHENII V USTROYSTVAKH AVTOMATICHESKOGO KONTROLYA TEKHNOLOGICHESKIKH PROTSESSOV. (Application of Nuclear Radiation in Automatic Control of Production Processes.) Nikolay Nikolayevich Shumilovskii and Lel'Vladimirovich Mel'tser. Moscow, Gosenergoizdat, 1958. 95p.

The basic properties of nuclear radiation and radiation meters employed in automatic control systems are discussed. Examples of specific systems used in industry are given, and their principles of construction are described. Use of nuclear radiation in automatic process control resulted in large savings in labor and material; examples of such applications in Soviet industry are discussed. (TCO)

20450

ISSLEDOVANIYE IZNOSA DETALEY AVIATSIONNOGO DVIGATELYA S POMOSHCH'YU RADIOAKTIVNYKH IZOTOPOV. (Investigating Wear of Aircraft-engine Components by Means of Radioactive Isotopes.) P. F. Grigor'yev. Moscow, AN SSSR, 1956. 12p.

In order to obtain continuous measurements of the wear of components of an operating engine, radioactive isotopes were used. The basic attribute of radioactive isotopes as indicators of wear is their property of radiating charged (α or β) particles or gamma rays as they decay. The advantage of the use of radioactive isotopes is that it permits simultaneous observation of the wear of several components during engine operation. Methods of component activation are given. None of these methods are suitable in practice for activation of such components as piston rings, cylinders, and crankshafts of aircraft engines. A new method was developed which consists of pressing inserts made of radioactive metal into the body of the component. The method developed permits continuous tracing of the dynamics of wear directly in an operating aircraft engine without dismantling it. (auth)

20451

MATERIALY X VSESOYUZNOGO SOVESHCHANIYA PO SPEKTROSKOPII, 1956. T. II: ATOMNAYA SPEKTROSKOPIYA. (Materials of the 10th All-Union Conference on Spectroscopy, 1956. Vol. 2: Atomic Spectroscopy). G. S. Landsberg, ed. [Lvov] Izd-vo L'vovskogo Univ., 1958. 568p.

Summaries of scientific and technical studies of atomic spectrography presented at the 10th All-Union Conference on Spectroscopy in 1956 are given. The studies cover phases of spectroscopy such as spectra of rare earths, electromagnetic radiation, physicochemi-

cal methods for controlling uranium production, physics and technology of gas discharge, optics and spectroscopy, abnormal dispersion in metal vapors, spectroscopy and the combustion theory, spectral analysis of ores and minerals, photographic methods for quantitative spectrum analysis of metals and alloys, spectral determination of the hydrogen content of metals by means of isotopes, tables and atlases of spectral lines, spark spectrographic analysis, statistical study of variation in the parameters of calibration curves, determination of traces of metals, spectrum analysis in metallurgy, thermochemistry in metallurgy, and principles and practice of spectrochemical analysis. (auth)

20452

VARIATSIONNYYE PRINTSIPY V TEORII STOLKNOVENII. (Variational Principles in the Theory of Collisions). Yuriy Nikolayevich Demkov. Moscow, Fizmatgiz, 1958. 168p.

Variational principles are studied from the viewpoint of stationary problems. No attention is given to the application of variational principles in relativistic quantum mechanics and field theory, although many of the results obtained are of a very general nature. Some of the included results are being published for the first time. (auth)

20453

RADIOAKTIVNYYE PREVRASHCHENIYA YADER I ATOMNAYA OBOLOCHKA. (Radioactive Transformations of Nuclei and the Atomic Shell). S. V. Starodubtsev and A. M. Romanov. Tashkent, Izd-vo AN Uzbekskoy SSR, 1958. 498p.

A wide range of theoretical and experimental problems encountered in the study of radioactive transformation is examined. Considerable attention is devoted to the role of atomic shells in processes of radioactive transformations. Experimental methods of investigating radioactive transformations which are directly connected with the shell (electron capture, γ-ray conversion) are discussed in detail. The influence of shells on the lifetime of radioactive atoms, on energy spectra, and on angular correlation of nuclear radiation is considered. The work done in spectrometry of recoil atoms and correlation of the direction of dispersion and polarization of particles during β transformations is analyzed in connection with the problem of the neutrino and the problem of β interactions. The examination of secondary effects during β disintegration (internal bremsstrahlung, pair production, etc.) and the theoretical and experimental research on the excitation and ionization of atoms and molecules during radioactive transformation occupy an important place in the book. Practical methods of separating isotopes and isomers, based on kinetic and electron activation of recoil atoms, are described. (auth)

Elementary Particles

20454 AECU-4272

Illinois. Univ., Urbana. Physics Research Lab. TABLES OF CROSS SECTIONS FOR π^+ PHOTOPRODUCTION FROM HYDROGEN, ACCORDING TO THE THEORY OF CHEW, GOLDBERGER, LOW, AND NAMBU. Technical Report No. 8. C. S. Robinson. May 22, 1959. 33p. Sponsored by National Science Foundation; ONR; and AEC under Contract Nonr-1834(05). $6.30(ph), $3.00(mf) OTS.

The differential cross section for photoproduction of π^+ mesons from hydrogen is given by Chew et al. as $(d\sigma/d\Omega) = (q/K)\, f_{+}^{2}$, where f_{+} is the photoproduction amplitude. This amplitude is derived. Numerical values of differential cross sections are given for 35 energies from 155 to 450 Mev. Total cross sections are tabulated for energies up to 230 Mev. (W.D.M.)

20455 AEC-tr-3591

HYPERONS AND K-MESONS. PART I. GENERAL CHARACTERISTICS OF HYPERONS AND K-MESONS. PART II. ISOTOPIC SPIN AND SYSTEMATICS OF FUNDAMENTAL PARTICLES. PART III. INTERACTIONS BETWEEN FUNDAMENTAL PARTICLES AND DIFFICULTIES OF THE THEORY. M. A. Markov. Translated from a publication of the Joint Institute for Nuclear Research, Moscow, 1957. 354p. $5.00(OTS).

This material is taken from lectures given at the Department of Physics at the Moscow State University and from various reports made during different periods of time at the Joint Institute for Nuclear Research. (W.D.M.)

20456 CEA-tr-R-648

SUR LA POSSIBILITÉ D'ACCÉLÉRER LES PROTONS POLARISÉS DANS LE CYCLOTRON. (The Possibilities of Accelerating Polarized Protons in the Cyclotron.) G. M. Budyanskii (Budiansky), Yu. (Iu.) A. Zavenyagin (Zaveniaguine), N. D. Fedorov, and V. A. Kharabrov (Khrabrov). Translated into French from Atomnaya Energ. 6, 306-10(1959). 14p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 12878.

20457

ROLE OF ANTINUCLEONS AND MESONS IN SECONDARY INTERACTIONS WITHIN HIGH ENERGY RANGE. Zh. Takibaev (Inst. of Nuclear Physics, Academy of Sciences, Kaz S.S.R.). Doklady Akad. Nauk. S.S.S.R. 127, 67-9(1959) July 1. (In Russian)

20458

SOLAR PROTONS AS RESPONSIBLE FOR MORNING AND NIGHT MAGNETIC PERTURBATIONS IN HIGH LATITUDES. A. P. Nikol'skiĭ (Arctic and Antarctic Research Inst.). Doklady Akad. Nauk S.S.S.R. 127, 82-5 (1959) July 1. (In Russian)

It is shown that S. Störmer's theory should be considered in developing the model of initial magnetic perturbation mechanisms at high latitudes. (R.V.J.)

20459

ON THE THEORY OF THE TRANSITION EFFECTS IN ELECTRODYNAMICS. G. M. Garibyan. Izvest. Akad. Nauk Armyan. S.S.R. Ser. Fiz. Mat. Nauk 11, No. 4, 7-12(1958).

The electromagnetic radiation which arises during the transition of a charged particle from one medium into another is considered. The case in which the particle path is inclined to the boundary of two media is examined. After a system of equations is solved, the explicit expressions for the components of the resulting radiation fields are obtained. The formulas are used to calculate the radiation which arises during the entrance of a particle from the vacuum into an ideal conductor and to determine the attraction on a charged particle by induced charges during the movement parallel with the surface of an ideal conductor. (TCO)

20460

THE EVALUATION OF EXPERIMENTAL RESULTS OF IONIZATION MEASUREMENTS. L. S. Bagdasaryan.

Izvest. Akad. Nauk Armyan. S.S.R. Ser. Fiz. Mat. Nauk 11, No. 4, 21-28(1958).

The rest mass of elementary particles from impulses and ionization were determined by use of a five-layer proportional recorder, a magnetic mass spectrometer, and two Wilson cameras. On the basis of measurements carried out with 6000 hard particles an ionization distribution curve was constructed, the width of which is 32.5% in the half height. The evaluation methods used for the experimental results are described. (TCO)

20461

THE OBSERVATION OF FAST DEUTERONS IN THE SYSTEM WHICH CONSISTS OF A MAGNETIC SPECTROMETER AND TWO WILSON CAMERAS. G. V. Badalyan. Izvest. Akad. Nauk Armyan. S.S.R. Ser. Fiz. Mat. Nauk 11, No. 4, 29-38(1958).

An instrument in the laboratory for cosmic radiation on the Aragats Mountain (3200 m) was used to obtain experimental data concerning the deuterons of cosmic radiation. It was possible to detect separately the deuterons from the air and the deuterons locally generated in the material of the instrument cameras. It appears probable that under nuclear effects in the air a considerable quantity of deuterons is generated. The obtained results are compared with former data and show good coincidence with them. (TCO)

20462

ANTIPROTON ANNIHILATION IN NUCLEAR EMULSIONS. A. H. Armstrong and G. M. Frye, Jr. (Los Alamos Scientific Lab., N. Mex.). Nuovo cimento (10) 13, 77-84(1959) July 1.

Sixteen antiproton stars observed in an emulsion stack exposed at the Berkeley Bevatron to a beam of negative particles of momentum 700 Mev/c were analyzed in detail. It is found that in the elementary antiproton-nucleon annihilation an average of 4.7 ± 0.6 mesons are produced, each with an average total energy of 348 ± 28 Mev. No strange particles were observed as annihilation products. (auth)

20463

EFFECT OF $\overline{K}^0$-K^- MASS DIFFERENCE ON K^--N INTERACTIONS AT LOW ENERGIES. J. D. Jackson and H. W. Wyld, Jr. (Univ. of Illinois, Urbana). Nuovo cimento (10) 13, 85-95(1959) July 1.

The R matrix formalism of Wigner and Eisenbud is used to modify the zero range S wave analysis of the scattering and absorption of K^- mesons on protons proposed by Jackson, Ravenhall, and Wyld so as to take into account the kinematical effects of the $\overline{K}^0$-K^- mass difference. It is found that even with a mass difference, the elastic, charge exchange, and absorption cross sections can be expressed in terms of two complex scattering lengths. The elastic and absorption cross sections exhibit cusps at the threshold for charge exchange scattering. The shape of the cusps can be used to distinguish between otherwise indistinguishable sets of scattering lengths. If the $\overline{K}^0$ and K^- have opposite parities there is no cusp in the elastic scattering cross section, so that in principle it is possible to determine the relative parity of $\overline{K}^0$ and K^- from the energy dependence of the K^- scattering cross section. (auth)

20464

POLARIZATION EFFECTS IN Σ^- HYPERONS CAPTURE BY DEUTERONS. O. D. Cheishvili and S. G. Matinyan (Georgian Academy of Sciences, Tiflis, U.S.S.R.). Nuovo cimento (10) 13, 108-14(1959) July 1.

A phenomenological treatment of polarized Σ^- hyperon capture by deuterons with the production of Λ^0 particles is given. The quantitative investigation shows that the study of polarization correlations of these particles allows to obtain certain information about the polarization state of a Σ^- particle. (auth)

20465

THE PARITY OF K-MESONS AND DISPERSION RELATIONS. M. M. Islam (Imperial Coll. of Science and Tech., London). Nuovo cimento (10) 13, 224-7(1959) July 1.

The Matthews-Salam dispersion relation gives a pseudoscalar or scalar K meson according to whether the K^--p potential is attractive or repulsive, though the experimental data of Burrowes do not indicate that the contribution due to the energy region beyond $5m_K$ will be negligible. Igi's dispersion relation also gives a pseudoscalar or a scalar K meson, if σ^+ is taken to be constant in the low-energy region and the K^--p potential is considered attractive or repulsive, respectively. (auth)

20466

DETERMINATION OF THE MESON-NUCLEON COUPLING CONSTANT FROM NUCLEON-NUCLEON SCATTERING. H. McManus (Chalk River Labs., Ont., Can.). Nuovo cimento (10) 13, 228-30(1959) July 1.

The results presented show that smoothed experimental data, as represented by a phenomenological potential, support Chew's hypothesis on the meson-nucleon coupling constant from nucleon-nucleon scattering. (C.J.G.)

20467

UP-DOWN ASYMMETRIES OF Σ AND Λ DECAYS. B. D'Espagnat and J. Prentki (CERN, Geneva). Phys. Rev. 114, 1366-7(1959) June 1.

Starting from a phenomenological analysis of the Σ decays an extension is made to Λ (and Ξ) decays using global symmetry (and M space). The relative values and signs of the asymmetry parameters are predicted. (auth)

20468

PION-PION CORRELATIONS IN ANTIPROTON ANNIHILATION EVENTS. Gerson Goldhaber, William B. Fowler, Sulamith Goldhaber, T. F. Hoang, Theodore E. Kalogeropoulos, and Wilson M. Powell (Univ. of California, Berkeley). Phys. Rev. Letters 3, 181-3(1959) Aug. 15.

Angular correlation effects were observed between pions emitted from antiproton annihilation events. The experiment was carried out with a separated antiproton beam of momentum $p_{\bar{p}} = 1.05$ Bev/c. A total of 2500 annihilation events was observed in 20,000 pictures. Results show that the distribution of the angles between pions of like charges is strikingly different from the distribution of the angles between pions of unlike charges. (W.D.M.)

20469

PROTONS FROM THE SUN ON MAY 12, 1959. E. P. Ney, J. R. Winckler, and P. S. Freier (Univ. of Minnesota, Minneapolis). Phys. Rev. Letters 3, 183-5 (1959) Aug. 15.

In the past year evidence has been accumulating that high-energy nucleons arrive at the earth following solar disturbances. Such an event is described which occurred on May 12, 1959. Ion chambers, Geiger and scintillation counters, and photographic emulsions were exposed above Minneapolis at a pressure altitude of 10 g/cm^2

throughout the period of enhanced intensity. The integral flux of particles at the top of the atmosphere increased by approximately a factor of 1000 above that of cosmic rays, and the composition of the incoming flux was essentially pure hydrogen. (W.D.M.)

20470

SEARCH FOR LEPTONIC DECAYS OF THE SIGMA. Jack Leitner, Paul Nordin, Jr., Arthur H. Rosenfeld, Frank T. Solmitz, and Robert D. Tripp (Univ. of California, Berkeley). Phys. Rev. Letters 3, 186-8(1959) Aug. 15.

As part of a continuing study of 8000 K absorptions in hydrogen, approximately 2000 Σ decays were examined for evidence of leptonic modes. The search for leptonic decay modes was carried out by studying the momentum distribution of the Σ^- decay products. Of the total sample, 750 Σ^- and 250 $\Sigma^+ \rightarrow \pi^+ + n$ satisfied the length of path criteria. (W.D.M.)

20471

PARITY OF THE SECOND PION RESONANCE. L. F. Landovitz and L. Marshall (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. Letters 3, 190(1959) Aug. 15.

An ambiguity is pointed out in the interpretation of an experiment by Stein (Phys. Rev. Letters 2, 473(1959)) on the polarization of the recoil proton in photoproduction in the vicinity of the second resonance: he found that at 90° cm the polarization was quite large, in fact, the polarization seemed to increase to what appears to be a maximum at or near the second resonance. (W.D.M.)

20472

MODIFICATION OF THE EFFECTIVE-RANGE FORMULA FOR NUCLEON-NUCLEON SCATTERING. H. Pierre Noyes and David Y. Wong (Univ. of California, Berkeley and Livermore). Phys. Rev. Letters 3, 191-3(1959) Aug. 15.

The effective-range formula is well known to be a useful description of low-energy scattering phase shifts. However, except at the limit of zero kinetic energy, the effective-range formula is, in general, not exact. A study is reported of the deviation from the effective-range formula in light of the analytic structure of partial-wave amplitudes as suggested by Mandelstam (Phys. Rev. 112, 1344(1958)). Consideration is given to the s-wave N-N scattering in both the singlet and the triplet states. (W.D.M.)

20473

THE SPACE STRUCTURE OF THE ATOMIC NUCLEUS. J. A. Smorodinskii (Joint Inst. of Nuclear Research, Dubna, U.S.S.R.). Priroda 48, No. 6, 3-12(1959) June. (In Russian)

A general review is given on the space structure of the atomic nucleus. The nuclear models, the radius of α decay, nucleon and electron scattering, and the radius of elementary particles are discussed.

20474

THE STRUCTURE OF NUCLEONS. D. I. Blokhintsev, V. S. Barashenkov, and B. M. Barbashov. Uspekhi Fiz. Nauk 68, 417-47(1959) July. (In Russian)

Methods are suggested for studying the structure of particles. The nuclear structure, the electromagnetic structure, and the effects of nucleons on nuclear structure are analyzed. An analysis and critical remarks are presented on Hofstadter experiments, and an attempt is made to interpret the electromagnetic structure of central nucleon areas. The optical nucleon model is also discussed. 60 references. (R.V.J.)

20475

STRANGE PARTICLES. (DECAY). L. B. Okun. Uspekhi Fiz. Nauk 68, 449-80(1959) July. (In Russian)

A review is given of the theory of elementary particle weak interactions. Special attention is devoted to the lepton decay of strange particles (K mesons and hyperons) while slow processes in nuclei (β decay, capture of μ mesons, and hypernuclear decay) are not discussed. The hypotheses on strongly interacting particles, on universal weak interactions, and on lepton interactions with strongly interacting particles are described. (R.V.J.)

20476

INVESTIGATIONS OF ELEMENTARY PARTICLES. B. I. Ioffe and L. B. Okun. Vestnik Akad. Nauk S.S.S.R. 29, No. 7, 17-26(1959) July. (In Russian)

A general review is given of the latest data on elementary particles. A table of elementary particles and their properties is included. (R.V.J.)

20477

ANGULAR DISTRIBUTION OF SHOWER PARTICLES IN STARS PRODUCED BY HIGH ENERGY PARTICLES. L. A. San'ko, Zh. S. Takibaev, Ts. I. Shakhova, and L. Ya. Balats (Inst. of Nuclear Physics, Academy of Sciences, Kazakh S.S.R.). Zhur. Eksptl'. i Teoret. Fiz. 37, 3-10 (1959) July. (In Russian)

An analysis is carried out of the angular distribution of a unique star consisting of 20 + 15 + 59 p and probably produced by a proton of energy >1000 Bev. The angular distribution of the shower particles is characterized by two maxima and is explained by the anisotropic angular distribution and power-law energy spectrum of the created particles in the c.m.s. The presence of a large number of strongly ionizing particles indicates that the Heitler–Terreaux theory does not give a correct description of π-meson production. The angular distribution of 11 other showers with the same characteristic anisotropy is also investigated. (auth)

20478

PHOTOPRODUCTION OF NEUTRAL π-MESONS ON HYDROGEN BY γ-QUANTA POSSESSING ENERGIES BETWEEN THE THRESHOLD AND 240 Mev. R. G. Vasilkov, B. B. Govorkov, and V. I. Gol'danskii (Lebedev Inst. of Physics, Academy of Sciences, S.S.S.R.). Zhur. Eksptl'. i Teoret. Fiz. 37, 11-22(1959) July. (In Russian)

The angular distributions of neutral π mesons produced in hydrogen by γ quanta with energies lying between the threshold and 240 Mev were investigated. The energy dependence of photoproduction was studied by employing the method of multichannel analysis of the data of the monitor and counters recording single decay γ quanta in an expanded synchrotron pulse. The angular distribution of the π^0 mesons in the c.m.s. has the form which signifies photoproduction of neutral π mesons not only in the P but also in the S state. The experimental data on the contribution of the S state agree with the results of the calculations presented earlier and permit one to estimate the contribution of direct π^0 meson photoproduction processes and "intranucleon charge exchange" of π^+ mesons in the S state. (auth)

20479

THE ULTRAVIOLET ASYMPTOTIC VALUE FOR K-MESON–BARYON INTERACTION. G. Vzhetsionko (J. Wrzecionko) (Joint Inst. of Nuclear Studies, Dubna, U.S.S.R.). Zhur. Eksptl'. i Teoret. Fiz. 37, 98-104 (1959) July. (In Russian)

The ultraviolet asymptotic value for K meson–baryon interaction is studied under various assumptions for the relative baryon parities, weak coupling being assumed. (auth)

20480

π^-–p-INTERACTION IN THE 1.4 Bev ENERGY REGION. V. I. Rus'kin (Inst. of Nuclear Physics, Academy of Sciences, Kazakh S.S.S.R.). Zhur. Eksptl'. i Teoret. Fiz. 37, 105-8(1959) July. (In Russian)

Fermi's statistical theory, in which account is made of resonance interactions between a π meson and nucleon or between two π mesons, is employed to explain the experimental results pertaining to 1.4 Bev π^-–p interaction. The results obtained are compared with the results of the isobar model proposed by Lindenbaum and Sternheimer (Phys. Rev. 109, 1723(1958)). (auth)

20481

ON COLLECTIVE LOSSES OF FAST ELECTRONS UPON PASSAGE THROUGH MATTER. V. P. Silin (Lebedev Inst. of Physics, Academy of Sciences, S.S.S.R.). Zhur. Eksptl'. i Teoret. Fiz. 37, 273-82 (1959) July. (In Russian)

Energy losses of fast electrons passing through thin films are considered from the viewpoint of the Tamm-Frank-Fermi theory which takes into account spatial dispersion of the dielectric permeability. An expression for the longitudinal dielectric constant which takes into account exchange effects was derived for a high-density electron gas. The longitudinal as well as transverse dielectric constants of a degenerate electron fluid were determined on the basis of Landau's phenomenological theory. It is shown that they possess singularities corresponding to the propagation of zero sound. Peculiarities of fast electron losses related to a possible excitation of longitudinal as well as transverse zero sound are discussed. The dependence of discrete losses on the scattering angle of a fast particle passing through optically anisotropic bodies is examined. (auth)

20482

ON THE INVESTIGATION OF π-MESON–HYPERON INTERACTION. L. I. Lapidus and Chou Kuang-Chao (Joint Inst. of Nuclear Studies, Dubna, U.S.S.R.). Zhur. Eksptl'. i Teoret. Fiz. 37, 283-8(1959) July. (In Russian)

It is shown that if the unitarity of the S-matrix is taken into account one can derive some information on the scattering of π mesons by Λ and Σ hyperons by analyzing the data on the interaction of K mesons with nucleons. The possibility of studying $\pi-\Lambda$ and $\pi-\Sigma$ interactions by investigating peripheral collisions between hyperons and nucleons is discussed. (auth)

20483

ENERGY CHARACTERISTICS OF SHOWER FORMING PARTICLES. E. D. Boos and Zh. S. Takibaev (Inst. of Nuclear Physics, Academy of Sciences, Kazakh S.S.R.). Zhur. Eksptl'. i Teoret. Fiz. 37, 292-3(1959) July. (In Russian)

20484

ON BORN AND PAIS METHODS FOR PHASE SHIFT DETERMINATIONS. T. Tits (Lodz Univ., Poland). Zhur. Eksptl'. i Teoret. Fiz. 37, 294-5(1959) July. (In Russian)

Short derivations are developed for the Born and Pais approximation, and a numerical correlation of phase shifts is made using the data obtained. (R.V.J.)

20485

MATRIX RECONSTRUCTION IN p–p SCATTERING AT 90° ANGLE. S. B. Nurushev (Joint Inst. of Nuclear Research, Dubna, U.S.S.R.). Zhur. Eksptl'. i Teoret. Fiz. 37, 301-2(1959) July. (In Russian)

20486

TOTAL CROSS SECTIONS FOR π MESON PHOTOPRODUCTION ON PROTONS AT LOW ENERGIES. R. G. Vasil'kov and B. B. Govorkov (Lebedev Inst. of Physics, Academy of Sciences, U.S.S.R.). Zhur. Eksptl'. i Teoret. Fiz. 37, 317-18(1959) July. (In Russian)

Measurements were made of the total cross sections for π^0 photoproduction at the threshold for ~245 Mev γ quanta. The experiments were carried out on a 265-Mev synchrotron with a liquid hydrogen target. The washout of the maximum bremsstrahlung energy spectra was ±1 Mev. The photon decay yield curve was measured with an order of precision of 2 to 3%. The background of the empty target was 8 to 10%. The relation of the decaying γ quantum formation cross sections to photon energies was calculated using the yield curve by the "photon difference" method. (R.V.J.)

20487

TRIPLE ELECTRON μ MESON DECAY. I. I. Gurevich, B. A. Nikol'skiĭ, and L. A. Surkova. Zhur. Eksptl'. i Teoret. Fiz. 37, 318-19(1959) July. (In Russian)

An event of triple relativistic electron emission at the μ-meson stopping point was observed during measurements of electron angular distribution asymmetry in $\pi \rightarrow \mu \rightarrow e$ decay. The microprojection of the μ meson triple-electron decay shows that all three electrons have a large deflecting angle to the emulsion plane. The recorded electron tracks and the angles between the electrons are given. The observed event is interpreted as $\mu^+ \rightarrow e^+ + e^+ + e^- + \nu + \tilde{\nu}$; however, the interpretation does not qualify whether this is a case of virtual or real conversion of γ quantum into an electron-positron pair. One of the suggested explanations postulates that this represents the decay $\mu^+ \rightarrow e^+ + \nu + \tilde{\nu} + \gamma$ followed by γ quantum conversion into a pair. The event was observed among 50,000 μ meson decays; hence, the relative probability of the μ meson "triple-electron" decay should be estimated as $p(3e)/p(e) < 2 \times 10^{-5}$. Considering that there was only one event of "triple electron" decay, a possibility of accidental superposition of tracks is not excluded. (R.V.J.)

20488

THE ENERGY DEPENDENCE OF POSITRON SPATIAL ASYMMETRY IN $\pi^+ \rightarrow \mu^+ \rightarrow e^+$-DECAY. A. O. Vaĭsenberg, V. A. Smirnitskiĭ, E. D. Kolganova, and N. V. Rabin. Zhur. Eksptl'. i Teoret. Fiz. 37, 326-8(1959) July. (In Russian)

The asymmetry coefficient energy dependence was measured, and the differential spectrum of the dependence was found. Some 565 positron tracks were selected using the criterion in which the $\pi^+ \rightarrow \mu^+ \rightarrow e^+$ decay sequence takes place in one emulsion layer, the $\mu^+ \rightarrow e^+$ decay apex is not less than 100 μ from the surface of the emulsion, the positron tracks are not less than 1 μ and the μ-meson and positron track projections on the emulsion surface form angles at $0 \pm 45°$ (first quadrant of the ocular scale) and $180 \pm 45°$ (opposite third quadrant of the scale) with the magnetic field. The obtained differential spectrum a(E) shows rapid growth with energy and agrees with the two component neutrino theory. At small energies the measurements did not find any positive asymmetry. (R.V.J.)

20489

ONE SYMMETRY IN τ^0 DECAY. M. I. Shirokov. Zhur. Eksptl'. i Teoret. Fiz. 37, 328-9(1959) July. (In Russian)

Assuming the $K_2^0 \rightarrow \pi^+ + \pi^- + \pi^0$ decay is independent in relation to charge conjugation, it is shown that the π^+ and π^- possess the asymmetry F (−p,p′) = F (p,p′), where p is proportional to the pulse differences π^+ and π^- in the center of inertia system of the reaction and p′ is the sum of these pulses. (R.V.J.)

20490

GIPERONY i K-MEZONY. (Hyperons and K-Mesons.) Moisey Aleksandrovich Markov. Moscow, Fizmatgiz, 1958. 345p.

A detailed review is given of experimental and theoretical work on the physics of the cosmic-ray hyperons and K mesons. (TCO)

20491

INTERNATIONAL CONFERENCE ON COSMIC RADIATION ORGANIZED BY THE HUNGARIAN ACADEMY OF SCIENCES. E. Fenyves and A. Somogyi, eds. Budapest, Magyar Tudomanyos Akademia, 1957. 187p.

Reviews of the papers read at the six plenary sessions of the conference are presented. Problems dealt with include nuclear emulsions, extensive air showers, and the program of cosmic ray measurements planned for the International Geophysical Year. Most of the reports are followed by references. (TCO)

20492

SPEKTROMETRIYA BYSTRYKH NEYTRONOV. (Spectrometry of Fast Neutrons.) B. V. Rybakov and V. A. Sidorov. Moscow, Atomizdat, 1958. 175p.

Spectrometric aspects of fast neutrons with energies ranging from 0.3 to 30 Mev were studied. Main interest is focused on the time-of-flight method, a new approach to this energy range. In addition to a review of work done on the time-of-flight method, original contributions based on experimental work done at the Institute of Atomic Energy are included. A general review is given of other methods in current use. (auth)

Heat Transfer and Fluid Flow

20493 BMI-872

Battelle Memorial Inst., Columbus, Ohio.

TEMPERATURE DISTRIBUTIONS IN A REACTOR FUEL PLATE. J. W. Chastain, J. K. Long, R. F. Redmond, R. E. Grimble, and R. W. Dayton. Sept. 25, 1953. Decl. Aug. 10, 1959. 60p. Contract W-7405-eng-92. $9.30(ph), $3.60(mf) OTS.

A large-scale model simulating one channel of a fuel subassembly, proposed for the SCW reactor, was built. This subassembly consisted of alternate flat and corrugated fuel plates. The channel walls of the model were heated electrically and the heat was removed by a coolant flowing through the model at atmospheric pressure. The temperature distribution around the periphery was measured for various coolants and flow rates, chosen to bracket reactor conditions. From these data, local heat-transfer coefficients were calculated. The model coefficients were interpolated to obtain an isothermal distribution of heat-transfer coefficients for three stations along the reactor channel. These heat-transfer coefficients and data on heat transfer to supercritical water in circular tubes were used to calculate the temperature field in the fuel plates of the subassembly. The method of cyclic heat was used to measure the average heat transfer coefficient in the subassembly. The experimental data are plotted as Stanton number versus Reynolds number. (auth)

20494 BMI-906

Battelle Memorial Inst., Columbus, Ohio.

TEMPERATURE DISTRIBUTIONS IN A REACTOR FUEL PLATE. II. PARALLEL PLATES WITH LONGITUDINAL CYLINDRICAL SPACERS. R. F. Redmond, J. W. Chastain, J. K. Long, R. G. Jung, and S. L. Fawcett. Mar. 12, 1954. Decl. Aug. 10, 1959. 28p. Contract W-7405-eng-92. $4.80(ph), $2.70(mf) OTS.

The effect upon the fuel-plate temperatures of introducing channel spacers into the proposed curved-plate subassembly for the supercritical-water reactor was studied and evaluated. Two arrangements of short cylindrical spacers in the coolant channels were considered. The temperature field in the vicinity of a channel spacer was obtained by approximating the appropriate differential equations by difference equations and solving these difference equations with an electrical analog. The needed local heat-transfer coefficients were estimated on the basis of local heat-transfer experiments performed with water upon a large-scale model of the channel-spacer system. The results of these studies indicated that the presence of spacers lowered the lower fuel-plate temperatures in the spacer regions. The maximum spacer-region temperatures for the two arrangements were 1050 and 1120°F, whereas the maximum temperature for a region without spacers was computed to be 1200°F. The maximum temperature was lowered in the spacer region because the spacer acted as a cooling fin and also served to increase the over-all heat transfer in the spacer vicinity by increasing fluid turbulence. (auth)

20495 BMI-907

Battelle Memorial Inst., Columbus, Ohio.

TEMPERATURE DISTRIBUTIONS IN A REACTOR FUEL PLATE. III. PARALLEL PLATES WITH PERPENDICULAR CYLINDRICAL SPACERS. J. K. Long, J. W. Chastain, R. F. Redmond, R. G. Jung, and S. L. Fawcett. Mar. 12, 1954. Decl. Aug. 10, 1959. 22p. Contract W-7405-eng-92. $3.30(ph), $2.40(mf) OTS.

The fuel elements in a proposed configuration for the supercritical-water reactor consist of flat fuel plates separated by cylindrical spacers perpendicular to the plates. Local temperatures were computed in the cylinders and adjacent fuel plates. The heat-transfer characteristics of the cylinder were taken from the literature, while those for the adjacent fuel plate were determined experimentally on a large-scale model. Several cases were considered representing different degrees of thermal contact between the fuel plate and the cylindrical spacer. In no case was the plate temperature increased because of the presence of the spacer. A local area of good heat transfer is induced on the downstream side of the spacer. This area of good heat transfer compensates for the lack of heat transfer from the region covered by the spacer. As a result, in one case where the spacer was in good contact with the plate, local temperatures were significantly decreased. (auth)

20496 ORNL-1716

Oak Ridge National Lab., Tenn.

TURBULENT HEAT TRANSFER FROM A MOLTEN FLUORIDE SALT MIXTURE TO SODIUM–POTASSIUM ALLOY IN A DOUBLE-TUBE HEAT EXCHANGER. D. F. Salmon. Nov. 3, 1954. Decl. July 16, 1959. 31p. Contract W-7405-eng-26. $4.80(ph), $2.70(mf) OTS.

Mixtures of fluoride salts were found to show promise for the circulating-fuel application. An experiment to

measure the heat transfer characteristics of the fluoride salt mixture $NaF-ZrF_4-UF_4$ was performed. A correlation of film heat transfer coefficients and the effect on heat transfer of deposits resulting from corrosion or mass transfer of container materials are reported. (J.E.D.)

20497 ORNL-2669
Oak Ridge National Lab., Tenn.
EXPERIMENTAL FORCED-CONVECTION HEAT TRANSFER WITH ADIABATIC WALLS AND INTERNAL HEAT GENERATION IN A LIQUID METAL (thesis). G. L. Muller. Aug. 28, 1959. 108p. Contract W-7405-eng-26. $2.50(OTS).

Submitted to the Univ. of Tennessee.

The investigation is an extension of the experimental and analytical work of H. F. Poppendiek into the specific volume-heat-source heat-transfer problem of the flow of a liquid metal (mercury) in long, smooth, insulated pipes under internal heat generation conditions. A second aspect of this study arises in the system design whereby the adiabatic wall (by assuring that interfacial resistances will not affect the experimental results) affords a direct test of the Martinelli modification for liquid metals of the heat transfer-momentum transfer analogy. (auth)

20498 AEC-tr-3796
A NEW INSTRUMENT FOR MEASURING THE HEAT CONDUCTIVITY OF LIQUIDS AND VAPORS AT HIGH TEMPERATURES AND PRESSURES. A. K. Abas-Zade. Translated for Atomics International Div. from Doklady Akad. Nauk Azerbaidzhan. S.S.R. 3, 3-7(1947). 7p. $1.80(ph), $1.80(mf) JCL or LC.

An apparatus designed for use at pressures of 200 atm. and 400°C is described. The heat conductivity of some liquids can be measured both at and above their critical state using this device. Operation and measurement results of selected examples are also included. (J.R.D.)

20499 AERE-Trans-828
THE RESISTANCE DURING THE MOVEMENT OF A TWO-PHASE SYSTEM IN HORIZONTAL PIPES. A. A. Armand. Translated by V. Beak (U.K.A.E.A. Atomic Energy Research Establishment) from Izvest. Vsesoyuz. Teplotekh. Inst. im. Feliksa Dzerzhinskogo 15, 16-23 (1946). 19p.

Experiments were conducted in smooth brass pipes. The air content was varied from 0 to 95% by weight, and the throughput of water was varied from 4200 to 10 kg/hr. Visual observations and cinematographic evidence indicate the existence of a diversified stream structure. A scheme of all flow types observed is given, and formulas to express these types are deduced. (J.R.D.)

20500
A METHOD OF EXAMINING FLOW OVER FINNED TUBES. A. Atherton. Brit. Chem. Eng. 4, 398-402 (1959) July.

The technique developed affords a satisfactory means of estimating mass transfer from transversely-finned tubes of the type used in gas-cooled nuclear reactors. The use of probes, which would adversely affect the flow conditions, is completely obviated, the methods used are straightforward and the apparatus simple. In future research it is intended to measure the intensity of turbulence inside the fin-spaces by means of statistical analyses of the "steady-state" or equilibrium efflux patterns, and to attempt to establish the nature of the correlation between this quantity and mass transfer. There also exists the possibility of obtaining further information about the turbulent diffusion process operating, by analyzing the functions f(t) for different fin arrangements. (auth)

20501
THERMAL CONTACT RESISTANCE BETWEEN CYLINDRICAL METALLIC SURFACES. E. Brutto, I. Casagrande, and G. Perona (CISE, Milan). Energia nucleare (Milan) 6, 532-40(1959) Aug.

A simple method suitable for measuring the thermal contact resistance between cylindrical surfaces is described, and the approximation obtainable is given. Some results on Cu clad by drawing with Al are reported and discussed. (auth)

20502
THERMAL CONDUCTIVITY OF MULTICOMPONENT GAS MIXTURES. II. E. A. Mason and S. C. Saxena (Univ. of Maryland, College Park). J. Chem. Phys. 31, 511-14(1959) Aug.

An investigation is made of the accuracies of the two recently derived formulas for the translational thermal conductivity of multicomponent gas mixtures. It is found that neither formula is sufficiently accurate in all cases, but that a slight modification of the Muckenfuss-Curtiss formula makes it as accurate as current experimental measurements. The modification consists of the replacement of first approximations to binary diffusion coefficients by more accurate values. (auth)

20503
THE EXPERIMENTAL INVESTIGATION OF THE TURBULENT FLOW EFFECT IN TUBES OF SMALL DIAMETER. N. S. Torocheshnikov and Zh. A. Koval'. Nauch. Doklady Vysshei Shkoly Khim. i Khim. Tekhnol. No. 3, 603-6(1958).

The effects of the turbulent flow on construction factors of small-diameter tubes were investigated. By means of the experimental results obtained, the graphical representation of the change of the cooling effect was determined. Construction factors such as the diameter of the tube diaphragm, the diaphragm opening, and the length of the hottest part of the tube were examined. In tubes with a small diameter the maximum cooling effect occurs at a ratio of $d_T:d_D:d_C = 4:2:1$, and the lowest temperature is reached at a ratio of 4:1.5:1. In the case of a decrease of the ratio $L:D_T < 50$ a decrease in the cooling effect occurs. In the case of an increase of the air pressure (higher than 6 atm. excess pressure) a slowing down in the increase of the cooling effect occurs. (auth)

20504
ON THE RATE OF STEAM-RAISING IN HIGH-PRESSURE DRUM-TYPE BOILERS. V. G. Chakrygin. Teploenergetika No. 3, 35-9(1959).

An analysis of the temperature distribution in the main drum of a boiler during the process of raising to steam from cold is presented. Recommendations are made for determining the rate of this process in high-pressure drum-type boilers. The main factors limiting further progress in this direction are uneven heating of the main drum, and the resultant stresses. In view of the complexity of the temperature field in the drum during the process of raising steam, it is treated as a resultant of the superposition of two fields: one in the wall thickness and another on the perimeter and length of the drum. The maximum permissible temperature difference in the wall thickness is assumed to be 50°C.

The temperature distribution in the wall thickness of the drum is considered, and the method of determining the temperature distribution in the ends of the drum is explained. The temperature distribution in the length and perimeter of the drum are then considered. During the starting-up period, conditions in the main drum are complicated because the upper part is heated by condensing steam and the lower part by water. Special studies were made on a boiler type PK-10 to investigate the heating conditions in the drum during starting from the cold. Temperature changes at particular points in the main drum of the boiler are plotted, together with temperature differences during starting up from cold in a period of 5.5 hours, as usually adopted by the station. (TCO)

20505

TEMPERATURE CONDITIONS IN THE METAL OF THE STEAM-RAISING SURFACES OF ONCE-THROUGH BOILERS. Z. L. Miropol'skii. Teploenergetika No. 3, 40-4(1959).

A review of published work on the subject is presented. As steam conditions are raised, the operating temperatures in metal heating surfaces approach limiting values. It is, therefore, important to develop methods of calculating the metal temperature throughout the steam/water path of the boiler. Temperature conditions in below-critical pressure operation are first considered. Diagrams of the temperature distribution, the flow, and the temperature of the internal wall surface of a tube are given. The diagram relates to the whole length of a coil of a once-through boiler with uniform heat flux distribution. The effect of the change-over from dropwise to filmwise evaporation is considered. Typical data on temperature changes in the walls of the tube with increase in the heat flux at high pressures are plotted. Values of the critical and permissible heat fluxes at pressures of 26, 100, 180, and 220 atm. obtained in tests with tubes 8 mm diameter heated over a length of 160 mm are plotted. The possible occurrence of dangerous conditions at the start or the end of the evaporative zone is explained. (TCO)

20506

PRESSURE PULSATIONS IN THE FLOW OF GAS AND THEIR EFFECT ON CONVECTIVE HEAT-EXCHANGE. S. I. Kosterin, I. A. Kozhinov, and A. I. Leont'yev. Teploenergetika No. 3, 66-72(1959).

Results of theoretical and experimental investigations of convective heat exchange in the presence of prolonged pressure pulsations in gas flow are presented. The first case to be considered theoretically is that of a turbulent boundary layer on a flat plate in the presence of periodic velocity pulsations in the main flow of gas. An integral equation for this case is written, and an equation is derived for the ratio of the resistance coefficient in the presence and absence of periodic velocity pulsations in the gas flows. The same equation can also be used to calculate the coefficients of heat and mass exchange under the same conditions. The case of a turbulent boundary layer in the initial section of a cylindrical tube is also considered in a similar manner. It is noted that there is an appreciable increase in the heat transfer coefficients when pressure pulsations are present. The test results are plotted to show the change of heat transfer coefficient and wall temperature along the length of the model. There is satisfactory agreement between theory and experiment. (auth)

20507

THE INFLUENCE ON HEAT TRANSFER TO WATER OF THE HEIGHT OF THE RECTANGULAR CROSS-SECTION OF A CHANNEL. N. L. Kafengauz and I. D. Bocharov. Teploenergetika No. 3, 76-8(1959).

Tests were made with equipment designed to study high rates of heat transfer to water below the boiling point, and contained in flattened tubes. The experimental tubes were seamless nickel, 3.6 mm diameter with a wall thickness of 0.15 mm, which were suitably pressed to give rectangular cross section over a working section of 50 mm length. The outsides of the tube were plated with copper but on one side only over the working section. Here the thickness of the copper was such that when electric current was passed through the tube not less than 0.9 of the heat was released in the copper layer. With this arrangement the experimental conditions approximated those of heat exchange with heating from one side. In all the tests the pressure in the tube was 40 atm. and the water temperature at the inlet was 15°C. Each series of measurements included determinations of the water speed at which the occurrence of critical heat exchange caused the tube to burn out. The test results are tabulated and plotted. It is evident that a change in the cross sectional height from 2 to 0.6 mm has no appreciable influence on this limiting water speed. From this it may be concluded that the geometrical dimensions of the rectangular section influence the critical heat transfer to the liquid only when the height of the rectangle is commensurate with the size of the steam bubbles. There is no available data about the size of steam bubbles under these conditions at a pressure of 40 atm but an approximate value is suggested. A simple method of estimating the water speed at which critical heat transfer occurs is explained. (TCO)

20508

RESEARCH PROGRAMMES FOR IMPROVING THE ECONOMY OF THERMAL POWER STATIONS IN THE USSR. M. S. Shkrob and B. I. Morozov. Teploenergetika No. 3, 85-7(1959).

The task of coördinating the efforts of Soviet research on the problems of high steam conditions are summarized. A list is given of the conferences which were organized on the subject. A similar list of research topics for 1959 is also given. Topics for research include drafting skeleton thermodynamic tables for water and steam, inventing and introducing new grades of heat-resistant steels of the pearlitic and austenitic classes for temperatures of 600 to 700°C, development of new grades of efficient and stable ion exchange resins suitable for water treatment, increasing the efficiency of large turbines by improving the aerodynamics of the blading, developing new types of burners and auxiliary equipment for unit sets with output of 300 to 600 Mw, seeking methods of raising the efficiency and reliability of boiler/turbine units, developing the automation of unit-type power stations, developing heat supply systems for large towns, and improving heat exchange processes in boilers, atomic reactors, and the steam generators of atomic power stations. (TCO)

20509

LITERATURE ON ONCE-THROUGH BOILERS. D. M. Bushuyev. Teploenergetika No. 3, 94-6(1959).

A list of about 135 Russian articles and books which have been published about once-through boilers since 1932 are presented. (TCO)

20510
A HIGH-TEMPERATURE ISOPIESTIC UNIT. B. A. Soldano, R. W. Stoughton, and R. J. Fox (Oak Ridge National Lab., Tenn.) and G. Scatchard (Massachusetts Inst. of Tech., Cambridge). p.224-35 of "The Structure of Electrolytic Solutions." W. J. Hamer, ed. John Wiley and Sons, Inc., 1959.

An isopiestic unit was constructed for work at elevated temperatures (up to 150°C or higher). Although the unit operated satisfactorily, alterations are being made which should substantially improve the accuracy of the data. Data to date show that in the temperature range of 25 to 100°C the osmotic coefficients of lithium chloride, bromide, and perchlorate as well as those of sodium fluoride and sulfate increase appreciably with temperature, and those of magnesium and uranyl sulfate decrease markedly with temperature, as contrasted with those of the alkali (not lithium) chlorides and bromides, which change very little with temperature. (auth)

20511
STRESSES IN HOLLOW CYLINDERS DUE TO ASSYMETRICAL HEAT GENERATION. Presented at Nuclear Engineering and Science Conference, April 6-9, 1959, Public Auditorium, Cleveland, Ohio. Preprint V-31. Harry Kraus (Westinghouse Electric Corp., Pittsburgh) and George Sonnemann (Univ. of Pittsburgh). New York, Engineers Joint Council, 1959. 23p. $0.50.

Equations are derived for the radial, tangential, shear, and axial stresses arising in nuclear reactor vessels, thermal shields, etc., from internal heat generation caused by the absorption of gamma radiation. The heat generation considered behaves as a decaying exponential through the wall of the hollow cylinder and is an arbitrary function of the angle around the axis of the cylinder. (auth)

20512
DESIGN SELECTION TECHNIQUE APPLIED TO ASTRO HEAT EXCHANGE. Presented at Nuclear Engineering and Science Conference, April 6-9, 1959, Public Auditorium, Cleveland, Ohio. Preprint V-42. J. R. Boyd (Lockheed Aircraft Corp., Palo Alto, Calif.). New York, Engineers Joint Council, 1959. 11p. $0.50.

This technique consists of the application of classical mathematics to formulate general arrangements of heat-producing elements in conjunction with a new entropy function. The entropy function defines the thermal loading imposed on the astro heat exchange requirement of the design. Aided by available state-of-the-art related to strength of materials and astro required radiant heat exchange, a physical design emerges suitable for astro flight. (auth)

20513
PRIKLADNAYA GIDROGAZODINAMIKA. (Applied Hydro- and Gas Dynamics). Isaak Pavlovich Ginzburg. Leningrad, Izd-vo Leningrad Univ., 1958. 337p.

This textbook on applied hydro- and gas dynamics is based on a series of lectures on mathematical mechanics. The basic equations of hydraulics and the theory of similitude and dimensional analysis are developed. Uniform and unsteady motions of fluids and gases in straight and curved pipes of uniform and varying cross section, the discharge of fluids and gases from containers, the time required to fill and empty vessels, and the reactions of flowing liquids and gases on rigid boundaries due to momentum changes are covered. Examples of the application of these methods to particular engineering problems are presented. (auth)

Nuclear Properties and Reactions

20514 AECU-4311
Minnesota. Univ., Minneapolis. School of Physics.
THE MECHANISM OF THE DIRECT INTERACTION PROCESS AT INTERMEDIATE ENERGIES. R. J. Griffiths and R. M. Eisberg. [1958]. 24p. $4.80(ph), $2.70(mf) OTS.

The results of an experiment on (p,2p) reaction at 40 Mev indicate that the direct interaction mechanism of N-N collisions in the diffuse nuclear surface is predominant at these energies and that the momentum of the struck nucleon is significantly lower than has been observed in experiments which measure the momentum distribution of nucleons which may be located anywhere within the nucleus. Using large solid-angle plastic scintillation counters and coincidence resolving times of ten mμ sec, measurements were made on the angular correlation in the range of separation angles 40 to 105°. Targets used were Cu, Ni, and Pb. (W.D.M.)

20515 AECU-4320
Arkansas. Univ., Fayetteville.
NEUTRON ACTIVATION CROSS-SECTIONS WITH 14.8 MEV NEUTRONS IN THE REGION OF THE 82-NEUTRON CLOSED SHELL (thesis). Raymond George Wille. 1959. 107p. $18.30(ph), $6.00(mf) OTS.

Fifty activation cross sections for (n,p), (n,α), and (n,2n) reactions on 27 stable nuclides of elements Ba, La, Ce, Pr, Nd, Sm, Eu, Gd, Dy, Er, Yb, and Lu were measured using 14.8 ± 0.8 Mev neutrons from the $T(d,n)He^4$ reaction. Total fluxes of 10^{10} to 10^{11} n/sec were obtained from the University of Arkansas 400 kv Cockcroft-Walton accelerator. The chemical form of the bombarded elements and the method of chemical separation are discussed individually for each element. (W.D.M.)

20516 CU-183
Columbia Univ., New York.
POLARIZATION OF NEUTRONS FROM THE REACTIONS $Li^7(p,n)Be^7$ AND $D(d,n)He^3$ (thesis). Joseph A. Baicker. Jan. 22, 1959. 73p. Contract AT-30-1-Gen-72. $2.00(OTS).

The degree of polarization of neutrons was measured for the $Li^7(p,n)$ reaction at a laboratory angle of 50° for proton energies from 3.0 to 6.0 Mev and for the D(d,n) reaction at a laboratory angle of 40° for deuteron energies from 2.0 to 4.5 Mev. Liquid helium contained in a thin-walled dewar was used as a polarization analyzer. A millimicrosecond time-of-flight system was used as a neutron spectrometer. For the $Li^7(p,n)$ reaction the polarization is approximately +0.35 in the proton energy region from 3.0 to 4.0 Mev and at E_p = 5.8 Mev it is −0.30. The polarization is zero at E_p = 5.1 Mev. Below 4 Mev only neutrons going to the ground state of Be^7 were counted, but for higher proton energies the measured polarization is the net value for the ground and first excited states combined. The (negative) polarization in the D(d,n) reaction has a maximum value of 0.21 at around E_d = 2.0 Mev, decreasing slowly to approximately 0.15 at E_d = 4.5 Mev. (auth)

20517 INSJ-19
Tokyo Univ. Inst. for Nuclear Study.
EVEN-EVEN NUCLEI. II. BETA TRANSITIONS. Mitsuo Sakai. July 1, 1959. 16p.

The beta transitions to low excited levels in medium weight even-even nuclei are reviewed. A certain number of new selection rules seems to play a role apart

from the normal selection rules. These rules may be one of the important clues for understanding the excited levels in medium weight nuclei and moreover they may serve as a powerful tool for determining an unknown decay scheme. (W.D.M.)

20518 ISC-1007

Ames Lab., Ames, Iowa.

THE NUCLEAR ENERGY LEVELS AND METASTABLE STATES IN THE DECAY OF Yb^{169}. George W. Eakins and E. N. Jensen. Dec. 1957. 73p. Contract W-7405-eng-82. $2.00(OTS).

The transitions in the electron capture decay of Yb^{169} to Tm^{169} were studied by means of an intermediate-image beta spectrometer to detect internal conversion electrons, and a scintillation detector to study gamma rays. Transition energies of 8.4, 20.8, 63.1, 93.6, 109.8, 118.2, 130.5, 177.2, 198.0, 240.4, 261.0, and 307.7 kev were measured. Measurements of gamma-gamma as well as beta-gamma coincidences were conducted which included both prompt and delayed coincidence runs. These data established the existence of nuclear energy levels at 8.4, 118.2, 139.0, 316.2, 379.3, and 472.9 kev above the ground state of Tm^{169}. The 316.2 and 379.3 kev levels were determined to be metastable with half-lives of 0.66 μsec and 0.06 μsec, respectively. The transition from the level at 472.9 kev was measured to be definitely prompt to less than 0.02 μsec. Multipolarity assignments were made based on the determined internal conversion coefficients, and spin and parity assignments to the nuclear energy levels were deduced on the basis of the transition multipolarities. The level assignments are in excellent agreement with those predicted by the Bohr-Mottelson unified model of the nucleus. The occurrence of the two metastable states as well as the rather unusual K-capture ratios are discussed. (auth)

20519 KAPL-M-PLE-1

Knolls Atomic Power Lab., Schenectady, N. Y.

THORIUM IN REACTOR CORE MATERIALS. P. L. Eisenacher. July 23, 1959. 14p. Contract W-31-109-Eng-52. $3.30(ph), $2.40(mf) OTS.

The fission rate per alpha disintegration per second of the parent materials was tabulated for Th, natural U, and enriched U. The data are graphed showing the spread in Th fission rate possible because of uncertainty in specific activity. If Th is alpha counted when its specific activity is minimum, the fission rate after 15,000 hours at 3×10^{13} nv will be 1.45 times the maximum rate which could occur if the contamination were U. (W.L.H.)

20520 NP-7766

Massachusetts Inst. of Tech., Cambridge.

ANGULAR DISTRIBUTION OF PROTONS FROM THE $Co^{59}(d,p)Co^{60}$ REACTION (thesis). Donald Lee Jarrell and Cornell Carpenter Angleman. June 1957. 89p.

The MIT-ONR electrostatic accelerator and broad-range magnetic spectrograph were used to investigate the $Co^{59}(d,p)Co^{60}$ reaction by bombarding a thin target of cobalt on Formvar with 6.0-Mev deuterons. An analysis of the proton groups for sixteen reaction angles between 10 and 110 degrees determined the angular distribution of the cross section and the Q-values for sixty levels of Co^{60} up to 3.7-Mev excitation. The ground-level Q-value was determined to be 5.262 ± 0.011 Mev. Some of the levels observed have not been previously reported, and the Q-values of the other levels are in agreement with those previously observed by (d,p) and (n,γ) reactions. One previously reported level at a Q of 2.659 Mev was not observed. The present values remove some small discrepancies between those of the (d,p) and (n,γ) reactions. From the angular distributions, the reaction was observed to proceed predominantly by stripping. They were compared with the predictions of Butler's stripping theory in order to assign values of l_n, the orbital angular momentum of the captured neutron, to thirty-seven levels. It was observed that most of the distributions required superposition of curves corresponding to two values of l_n. Results obtained endorse the recently assigned values of $J = 5^+$ for the ground level and $J = 2^+$ for the metastable state, instead of the previously reported values of 4^+ and 1^+, respectively. (auth)

20521 NP-7837

[Strasbourg. Universite. Institut de Recherches Nucleaires.]

APPLICATION DE LA METHODE DES CORRELATIONS ANGULAIRES A L'ETUDE EXPERIMENTALE DE NIVEAUX DE QUELQUES NOYAUX LEGERS (THESE). (Application of the Method of Angular Correlations to the Experimental Study of Levels of Some Light Nuclei (thesis).) André Gallmann. July 8, 1957. 114p.

The method of angular correlation was used to study the energy levels resulting from the reactions $B^{10}(d,p)B^{11}$, $C^{13}(p,\gamma)N^{14}$, and $N^{14}(p,\gamma)O^{15}$. The theory of angular correlations of nuclear radiations was discussed for the general case, and the formulas for the special case of double and triple correlations were derived. The experimental arrangement used is described in detail. The proton-gamma angular correlation in the B^{10} reaction was measured, and the results are discussed. The gamma-gamma angular correlation for the 6.23-Mev level in the C^{13} reaction at the 1.16-Mev resonance is compatible with the values J = 1+ or 2+ for the angular moment of the 6.23-Mev level of N^{14}. The $N^{14}(p,\gamma)$ reaction was studied at the 1060-kev resonance. The angular distribution of the 8.34-Mev gamma radiation was measured, and the gamma-gamma angular correlation of 5.27-Mev level was determined. 49 references. (J.S.R.)

20522 NP-7838

[Strasbourg. Université. Institut de Recherches Nucléaires.]

CONTRIBUTION A L'ETUDE EXPERIMENTALE DE NIVEAUX EXCITES DE QUELQUES NOYAUX RADIOACTIFS PAR LA MESURE DE LEUR PERIODE, PAR LA METHODE DES CORRELATIONS ANGULAIRES, ET PAR LA METHODE D'ORIENTATION NUCLEAIRE AUX BASSES TEMPERATURES. (Contribution to the Experimental Study of Excited Levels of Some Radioactive Nuclei by the Measurement of Their Period, by the Measurement of Angular Correlations, and by the Method of Nuclear Orientation at Low-Temperatures.) Albert Knipper. [1957]. 167p.

Several experimental methods were applied to the study of gamma rays emitted by radioactive nuclei. The method of delayed coincidences was used to obtain an upper limit of the order of 10^{-9} sec for the first excited level of Tl^{207} and Ni^{60} and for the second excited level of O^{16}. The period $T_{1/2} = (8 \pm 2) \times 10^{-10}$ sec was measured for the first excited level of B^{10}, and an upper limit of 4×10^{-10} sec was found for the 530-kev level of Pm^{147}. The gamma radiation emitted in the decay of Ag^{110} was studied with scintillation counters, and a simplified decay scheme was established. The excited

levels of Cd^{110} were determined. The isotopes Co^{57}, Ce^{141}, and Ce^{139} were studied by experiments of nuclear orientation. The sequences of probable angular moments were confirmed, and the gamma rays studied were identified as mixtures of M1 and E2 radiation. The magnetic moment and the mixing coefficient were determined. (J.S.R.)

20523 NP-7840

[Strasbourg. Université. Institut de Recherches Nucléaires].

SUR LA DETERMINATION DES ORDRES DE MULTIPOLARITE DES TRANSITIONS NUCLÉAIRES ELECTROMAGNETIQUES PAR CORRELATION ANGULAIRE DES PAIRES DE CONVERSION INTERNE. METHODE ET APPLICATION AUX NOYAUX ^{10}Be, ^{10}B, ^{14}C, ^{14}N, ^{40}Ca. (The Determination of the Orders of Multipolarity of Electromagnetic Nuclear Transitions by Angular Correlation of Interval Conversion Pairs. Method and Application to the Nuclei Be^{10}, B^{10}, C^{14}, N^{14}, Ca^{40}.) Pierre Chevallier. [1957]. 108p.

The order of multipolarity of electromagnetic nuclear transitions was measured by the determination of the angular correlation of internal conversion pairs. The transitions studied were 3.37 Mev of Be^{10}, 3.58 (3.58 Mev – 0.72 Mev) and 2.86 Mev of B^{10}, 6.09 Mev of C^{14}, 5.69, 5.10, and 4.91 Mev of N^{14}, and 3.35 Mev of Ca^{40}. The models used for these nuclei are briefly discussed. The formation of internal pairs is analyzed theoretically. The experimental techniques for the measurement of the angular correlations are given. The angular moments of some excited levels of the nuclei were determined from the order of multipolarity. Some of the angular moments can be interpreted by the theory of intermediate coupling, whereas the 3.35-Mev level of Ca^{40} is considered in the framework of doubly magic nuclei. (J.S.R.)

20524 OOR-1911.1

Pennsylvania State Univ., University Park.

STUDY OF RECOIL PROTON INITIATED REACTIONS. Interim Technical Report No. 1. Stanley S. Glickstein. May 18, 1959. 54p. OOR Project No. 1911. Contract DA-36-061-ORD-592.

A study of the flux of recoil protons is presented. Also, the feasibility of producing usable radiation sources by recoil proton reactions in a reactor is examined. Calculations of a fast proton flux due to the elastic scattering of fast neutrons were made and these results are compared to measurements made in the reactor. Reactor measurements include those of the fast neutron flux and flux fall-off at the center of the PSRR core north face and determination of the F^{18}, N^{13}, and C^{11} activity in samples of H_2O, $(C_2H_4)n$, and H_3BO_3 irradiated at this position. (J.R.D.)

20525 UCRL-8695

California. Univ., Berkeley. Lawrence Radiation Lab.

THE CROSS SECTION FOR COMPOUND-NUCLEUS FORMATION IN HEAVY-ION-INDUCED REACTIONS. T. Darrah Thomas. Apr. 1959. 36p. Contract W-7405-eng-48. $6.30(ph), $3.00(mf) OTS.

Compound-nucleus-formation cross sections for various systems of heavy ions and targets were calculated by using two simple models. The first model, based on a square-well nuclear potential, gives reasonable agreement with experiment if a radius parameter $r_0 \cong 1.5$ fermis is used. The second model, based on a diffuse nuclear potential, gives agreement if $r_0 = 1.17$ fermis is used. The cross sections calculated by using the first model are presented for various energies of the systems carbon, nitrogen, oxygen, and neon incident on aluminum, potassium, copper, silver, praseodymium, gold, and uranium. Also tabulated are the average values of the orbital angular momentum for each system at each energy. (auth)

20526 UCRL-8747

California. Univ., Berkeley. Lawrence Radiation Lab.

PION-MOMENTUM SPECTRUM FROM K^- ABSORPTION IN HELIUM. Jack Leitner. May 6, 1959. 20p. Contract W-7405-eng-48. $0.75(OTS).

The pion-momentum spectrum from K^--absorption stars in helium is calculated in the impulse approximation. The kaon is assumed to be pseudoscalar and to be captured from the 1s state. A final state consisting of free particles is used. The effect of final bound states is considered and taken into account phenomenologically. All final-state interactions are neglected. It is shown that the shape of the momentum spectrum is determined mainly by kinematics—i.e., the shapes and positions of the spectral peaks are quite insensitive to detailed dynamical assumptions such as the assumed K parity and capture orbit. The effect of final-state interactions is discussed. (auth)

20527 UCRL-8756

California. Univ., Berkeley. Lawrence Radiation Lab.

THE NUCLEAR SPINS AND MAGNETIC MOMENTS OF CERTAIN GOLD AND SILVER ISOTOPES (thesis). Wesley Bruce Ewbank. June 1959. 134p. Contract W-7405-eng-48. $2.75(OTS).

An atomic-beam magnetic-resonance apparatus operating on the flop-in principle was used to measure the nuclear spins and hyperfine-structure separations of the $^2S_{1/2}$ electronic ground state for several radioactive isotopes of silver and gold. The results of these experiments, together with calculated values of the nuclear magnetic-dipole moments, are given. (auth)

20528

THE OPACITY AT HIGH TEMPERATURES DUE TO COMPTON SCATTERING. Douglas H. Sampson (Los Alamos Scientific Lab., N. Mex.). Astrophys. J. 129, 734-51(1959) May.

The contribution to the radiative opacity of matter arising from Compton scattering is obtained for the entire region in which degeneracy in the electron distribution may be neglected. This corresponds to temperatures up to about 125 kev (1 kev = 11605800°K) and densities up to roughly 10^4 g cm^{-3} at the highest temperatures considered. It is found that, at temperatures for which the Klein-Nishina cross section should be used, parts of the scattering into and out of a beam of radiation do not cancel, as previously assumed. The result of this is to lower the opacity by about 13 per cent at kT = 20 kev and 37 per cent at kT = 125 kev. Although absorption resulting in pair-creation may be neglected at these temperatures, it is found that pair production is responsible in another way for a sharp rise in the opacity by increasing the density (N) of electrons and positrons significantly at the highest temperatures considered. In fact, at kT = 125 kev, the value of N corresponding to thermal equilibrium is large and almost independent of the matter density (ρ), where ρ does not include the mass of the electrons and positrons resulting from pair-creation. Hence, it is concluded that for kT > 125 kev, the average mean free path $\Lambda_C = (\rho K_C)^{-1}$ is small and independent of ρ. On the other hand, for kT < 30 kev, one has the familiar situa-

tion that the Compton opacity (K_c) is small and independent of ρ. (auth)

20529

THE FINE STRUCTURE IN THE FISSION YIELD CURVE FOR U^{233}. V. K. Gorshkov and M. P. Anikina. Atomnaya Energ. 7, 144-7(1959) Aug. (In Russian)

Measurements were made of the U^{233} fission yield of Ba^{138}, Sr^{88}, Sr^{90}, Y^{89}, and five isotopes of zirconium. The yield of Cs^{136} and Rb^{86} is estimated. The obtained data and previously published data are used for plotting graphs of the fission fragment yield. The graph shows the transition boundaries of light fragment, one neutron, and two neutron emisson. It is postulated that both structures are formed and related directly to the fission process moment. (tr-auth)

20530

THE GAMMA RADIATION FROM U^{235} AND Pu^{239} FISSION FRAGMENTS. Yu. I. Petrov. Atomnaya Energ. 7, 168-71(1959) Aug. (In Russian)

The γ energy of one fission event was measured by integrating the spatial dose distribution in water and by ionization measurements in air with the assumption that $h\nu$ = 1.5 Mev and by correlating U^{235} and Pu^{239} γ activity with standard specimens of Na^{23}. Measurements by the first two methods coincided with an order of accuracy of 5%, while the data of the last method differ by ~10%. (R.V.J.)

20531

ENERGY DISTRIBUTION OF FRAGMENTS FROM A TRIPLE FISSION OF URANIUM NUCLEI UNDER THE ACTION OF NEUTRONS. V. N. Dmitriev, L. V. Drapchinskiĭ, K. A. Petrzhak, and Yu. F. Romanov (Khlopin Radium Inst., Academy of Sciences, U.S.S.R.). Doklady Akad. Nauk S.S.S.R. 127, 531-3(1959) July 21. (In Russian)

One triple fission event was observed per 350 events of U^{235} double fission. The energy distribution of α particles was continuous with the maximum near 15 Mev. Maximum α energy was 28 Mev. The most probable angle between α particle emission and the light fragment direction is 80°. A double ionization chamber surrounded with an α chamber for eliminating the angular correlation was used in the investigation. The thicknesses were 20 $\mu g/cm^2$ for U^{235} and 10 $\mu g/cm^2$ for U^{233}. The effective solid angle of the α chamber in relation to the target was 12.5% at 4π. A 63 channel amplitude analyzer with an electron memory device was used for recording pulse amplitude spectra. Accidental coincidences between double fission fragments and background α chamber pulses was about 2% of the total number of coincidences. The triple fission fragment spectra from the U^{235} layer was plotted with consideration for ionization. The corrections were equal to 2.5 Mev. Comparisons of double and triple fission fragment spectra for U^{235} show that they are analogous in form, but a noticeable shift of peaks is observed toward lower energies. The energy peak shift ΔE_l = 9.5 Mev and ΔE_h = 7.5 Mev. Due to eliminated effects of angular correlation of fragments and α particles, the results of the experiments with U^{235} show higher peaks for light fragment than for the heavy ones. The measured parameters of U^{233} double and triple fission fragment energy distributions correspond to those of U^{235}. The total kinetic energy for U^{235} and U^{233} triple fission fragments is 17 Mev less than the corresponding total for double fission. With the probable triple fission combined with emission of 15 Mev α particle, the triple fission total kinetic energy is equal to the binary fission. (R.V.J.)

20532

SOME CONSEQUENCES OF THERMAL NEUTRON CAPTURE IN SILICON AND GERMANIUM. H. C. Schweinler (Oak Ridge National Lab., Tenn.). J. Appl. Phys. 30, 1125-6(1959) Aug.

The average value of the kinetic energy of recoil following thermal neutron capture and subsequent gamma-ray emission is 780 ev in silicon and 180 ev in germanium. For every neutron captured in silicon, 0.04 P^{31} atom (therefore, 0.04 excess electron) are formed by radioactive decay. For every neutron captured in germanium, 0.098 As^{75}, 0.012 Se^{77} (therefore, 0.122 excess electron), and 0.304 Ga^{71} atom (therefore, 0.304 excess hole) are ultimately formed, in this time sequence. Analysis of an experiment of J. W. Cleland on the decay of irradiated n-type germanium gives 0.8 electron removed from the conduction band per initially recoiling germanium atom. (auth)

20533

ANGULAR CORRELATION OF GAMMA RAYS FROM Xe^{126} AND Te^{126}. Mitsuo Sakai, Hidetsugu Ikegami, and Toshimitsu Yamazaki (Univ. of Tokyo) and Kazusuke Sugiyama (Tohoku Univ., Sendai). J. Phys. Soc. Japan 14, 983-6(1959) Aug.

The angular correlation of gamma rays in 2−2−0 cascade transitions in Xe^{126} and Te^{126} is measured from the decay of I^{126} in order to obtain the mixing ratio of competing E2 and M1 transitions in the 2−2 transition. The mixing ratio is found to have positive sign for both nuclei, as expected from the systematics of excited levels in even-even nuclei. (auth)

20534

DECAY OF I^{124}. Kazusuke Sugiyama (Tohoku Univ., Sendai) and Hidetsugu Ikegami, Toshimitsu Yamazaki, and Mitsuo Sakai (Univ. of Tokyo). J. Phys. Soc. Japan 14, 986-91(1959) Aug.

The gamma and beta rays following the decay of I^{124} which was produced by Sb^{124} (α, n) reaction have been studied with scintillation spectrometers both single and in coincidence, and with a beta-ray spectrometer. Three gamma rays at 2.74 Mev, 2.29 Mev, and 1.50 Mev and probably 0.9 Mev which were not found in decay of Sb^{124} were observed. The beta-gamma coincidence experiments revealed that the first positron group decays to the ground level of Te^{124} so that the energy difference between I^{124} and Te^{124} becomes 3.22 Mev, being consistent with beta decay energy systematics. In addition this beta component was found to have a unique 1st forbidden type spectrum, showing the spin and parity of the ground state of I^{124} is 2−. From these results one is led to conclude the presence of two new levels at 2.88 Mev and 2.74 Mev which the spin value is probably 1 and the parity is negative. A doublet level at the second excited level previously reported was not confirmed in the present experiment. However, a definite evidence of cross-over transition from the second level to the ground level was obtained which may indicate a presence of a 2+ level at the second excited level. The tentative decay scheme is proposed. (auth)

20535

MEASUREMENT OF PHOTONUCLEAR ABSORPTION CROSS SECTIONS. J. Kockum and N. Starfelt (Univ. of Lund, Sweden). Nuclear Instr. and Methods 5, 37-43 (1959) July.

The total photonuclear cross sections for carbon, aluminum, sulfur, and iron was measured in the energy region of the giant resonance. A total absorption scintillation spectrometer was used to study the transmis-

sion of the bremsstrahlung spectrum from a 30 Mev synchrotron through long absorbers. The integrated total photonuclear cross section between 10 and 27 Mev as well as the width of the giant resonance was obtained. The measured widths are definitely larger for the deformed nuclei aluminum and iron than for the spherical carbon nucleus, whereas the width for sulfur has an intermediate value. (auth)

20536

FORM FACTOR INFLUENCE ON PROCESSES OF BREMSSTRAHLUNG AND PAIR PRODUCTION ON PROTONS. P. S. Isaev and I. S. Zlatev (Joint Inst. for Nuclear Research, Dubna, U.S.S.R.). Nuovo cimento (10) 13, 1-11(1959) July 1.

The differential cross sections of the processes of electron bremsstrahlung and pair production by γ quanta on protons in presence of the form factor were calculated. This calculation was made in the lowest order of perturbation theory. The formula of the differential bremsstrahlung cross section was integrated over all angles, except the angle between the direction of the incident electron and that of the emitted photon. A comparison of the differential and integral bremsstrahlung cross sections with the corresponding Bethe-Heitler formulas was made. (auth)

20537

ANTIPROTON INTERACTION CROSS SECTIONS. A. G. Ekspong and B. E. Ronne (Inst. of Physics, Uppsala). Nuovo cimento (10) 13, 27-45(1959) July 1.

A study was made of 374 antiproton tracks in nuclear emulsions in the energy region 0 to 250 Mev. A path length of 37.3 m was followed. Ten new elastic $\bar{p}$-p scattering events together with eleven events published earlier yield an elastic scattering cross section of 77 ± 17 mb. The total and the differential elastic cross sections are consistent with the theory by Chew and Ball. The mean free path for annihilation in the energy region 30 to 250 Mev is 20.8 ± 1.6 cm, and the interaction mean free path is 18.3 ± 1.3 cm. An effective antiproton-nucleon cross section of (150^{+27}_{-22}) mb was deduced from an optical model calculation. Six new inelastic scattering events are reported. Putting these together with the 8 or 9 events published by Goldhaber et al. one gets an inelastic scattering cross section of 42 ± 11 mb per emulsion nucleus (hydrogen excluded). The low value of the cross section is discussed in the light of the optical model. The elastic scattering on complex nuclei seems to agree with a combination of Rutherford and diffraction scattering from a completely absorbing nucleus. (auth)

20538

$B^{11}(He^3,p)C^{13}$ AND $B^{11}(He^3,d)C^{12}$ REACTIONS. H. D. Holmgren, E. A. Wolicki, and R. L. Johnston (Naval Research Lab., Washington, D. C.). Phys. Rev. 114, 1281-5(1959) June 1.

The differential cross sections for the $B^{11}(He^3,p)C^{13}$ and the $B^{11}(He^3,d)C^{12}$ reactions have been measured at 4.5 and 5.4 Mev. Yield curves for these reactions have also been obtained over the energy region extending from 3.00 to 5.40 Mev. The angular distributions for the deuteron groups are strongly peaked in the forward direction and indicate that the simple stripping interaction is the predominant mechanism of these reactions. The angular distributions of the proton groups are more complex and more difficult to interpret; however the yield curves change rather slowly with energy suggesting that direct interaction mechanisms may be important. (auth)

20539

0- TO 0+ BETA TRANSITION $Pr^{144} \rightarrow Nd^{144}$. Fred T. Porter and Paul P. Day (Argonne National Lab., Lemont, Ill.). Phys. Rev. 114, 1286-96(1959) June 1.

The Argonne double lens beta spectrometer and associated coincidence circuit have been used to observe the beta transitions of Pr^{144}. The validity of the spin and parity assignment 0- to Pr^{144} is supported by a measurement of the shape of the $(1.2 \pm 0.1)\%$ abundant 2.3-Mev beta transition, observed in coincidence with the 697-kev gamma ray. Its shape is that of the unique ($\Delta I = 2$, yes) first forbidden transition expected if the transition goes from 0- Pr^{144} to the 2+ first excited state of even-even Nd^{144}. The shape of the $(1.0 \pm 0.1)\%$ abundant 807 ± 5-kev beta transition to the 2.19-Mev level in Nd^{144} was observed in coincidence with the 1.49 and 2.19-Mev gamma rays. Its allowed shape is consistent with a 0- assignment for Pr^{144}. With this assignment the transition between the ground states is a 0- to 0+ case. The shape of this 2996 ± 3 kev 97.8% abundant transition was obtained from the total spectrum by small subtractions of the inner groups. Its nearly allowed shape is easily explained with a pure axial vector shape factor; in contrast, the tensor-pseudoscalar formalism fails to reproduce the shape. The ratio of axial vector matrix elements $\lambda = (i\int\gamma_5/\int\sigma\cdot r)$ can be determined from the shape; our data give $\lambda = 5 \pm 2$. This is the same absolute magnitude as some theoretical estimates but has the opposite sign. The experimental results are in good agreement with those of Graham, Geiger, and Eastwood who have already pointed out that this 0- to 0+ transition does not offer a sensitive measure of the relative size of pseudoscalar to axial vector coupling constants although the net relative contribution of the direct pseudoscalar part to the whole AP shape factor must be $\lesssim$1% (with Rose-Osborne formalism). An incidental result of the present work is that the Hp of the K conversion line of the 133.5-kev transition following the β decay of Ce^{144} has been measured as 1064.8 ± 0.6 gauss-cm. (auth)

20540

GAMMA RAYS FROM THE 1.83-Mev RESONANCE IN THE REACTION $Mg^{24}(p,\gamma)Al^{25}$. A. E. Litherland, H. E. Gove, and A. J. Ferguson (Atomic Energy of Canada, Ltd., Chalk River, Ont.). Phys. Rev. 114, 1312-19(1959) June 1.

The $Mg^{24}(p,\gamma)Al^{25}$ reaction has been studied in the range of proton energies from 1.66 to 2.02 Mev. A new resonance at 1.833 ± 0.007 Mev was observed which corresponds to an excited state of 4.047 ± 0.010 Mev in Al^{25}. The new excited state was observed to decay by the emission of 4.01 ± 0.04, 2.43 ± 0.04, and 1.62 ± 0.03 Mev gamma rays. The last two gamma rays were observed to be in coincidence and the intensity ratio of the first two gamma rays was found to be 60 ± 10:40 ± 10. The experimental value of $\omega\gamma = (J + \frac{1}{2})\Gamma_p\Gamma_\gamma/\Gamma$, for the ground state transition was found to be 3×10^{-3} ev and an upper limit of 10 kev was estimated for Γ, the total width of the resonance. Angular distribution measurements have shown that the angular momentum of the new state is either 5/2 or 9/2 with the latter value favored. On the basis of the observed dipole-quadrupole admixtures found for the gamma rays the parity of the new state is probably even. A discussion is given of the place of the new state in the rotational-like bands of Al^{25}. (auth)

20541

PRECISION MEASUREMENT OF THE $Be^9(\gamma,n)$ CROSS

SECTION. J. H. Gibbons, R. L. Macklin, J. B. Marion, and H. W. Schmitt (Oak Ridge National Lab., Tenn.). Phys. Rev. 114, 1319-23(1959) June 1.

Measurements have been made of the photoneutron cross section for Be^9 using γ rays from radioactive sources of Y^{88} (1.85 Mev) and Sb^{124} (1.69 Mev). The values obtained at these two energies are $(6.54 \pm 0.31) \times 10^{-28}$ cm^2 and $(12.62 \pm 0.69) \times 10^{-28}$ cm^2, respectively. The limiting factors in the accuracy of these measurements are the uncertainties in the γ-ray source strength calibration and in the NBS No. 2 Ra-γ-Be neutron source standard, and the lack of precise knowledge concerning the Sb^{124} decay scheme. A new measurement of the γ-ray branching ratios in the Sb^{124} decay has also been made. (auth)

20542

NUCLEAR PHOTON ABSORPTION IN CARBON AND OXYGEN. A. S. Penfold and E. L. Garwin (Univ. of Chicago). Phys. Rev. 114, 1324-8(1959) June 1.

The importance of narrow, isolated, resonances in the photonuclear absorption cross sections of C and O was investigated by means of an absorption experiment performed with 30.7-Mev bremsstrahlung. The experiment yielded values for the cross sections averaged over the (γ,n) cross sections for C^{12} and O^{16}. The results for C were the same as those expected for a cross section without narrow resonances, while for O a definite resonance effect was demonstrated. The O photonuclear absorption cross section, averaged over the $O^{16}(\gamma,n)O^{15}$ cross section, was found to be 26.7 ± 3.5 millibarns, 16 ± 4 millibarns higher than the value expected if narrow resonances contribute insignificantly. Estimated values for the parameters of the O resonances near 22 Mev are: average peak height, 106 ± 14 mb; ratio of the radiative width (to ground state) to total width, $(6.6 \pm 0.9) \times 10^{-3}$; total width about 30 kev. The experimental results are insensitive to uncertainties in the non-nuclear x-ray attenuation cross sections for C and O. (auth)

20543

RATIO OF THE GAMOW-TELLER AND FERMI COUPLING CONSTANTS DETERMINED FROM ft VALUES. O. C. Kistner and B. M. Rustad (Columbia Univ., New York and Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 114, 1329-32(1959) June 1.

A comparison is made of the ratios of the squares of the Gamow-Teller and Fermi coupling constants, C_{GT}^2/C_F^2, calculated from the latest experimental ft values and the theoretical matrix elements for the "doubly closed shell ± one nucleon" mirror transitions and the 0^+-0^- transitions. The ft value of the neutron derived from the recent half-life measurement of 11.7 ± 0.3 minutes leads to a value for C_{GT}^2/C_F^2 of 1.42 ± 0.06, which is in agreement with the ratio obtained from the correlation coefficient for the beta-particle momentum and the spin direction of the decaying neutron. The ft value for the decay of H^3 is also in good agreement with this ratio if the Gamow-Teller matrix element for this transition does not differ appreciably from that predicted by the individual particle model. The ft value of the heavier mirror nuclei, O^{15}, F^{17}, and Ca^{39}, are consistent with a considerably lower ratio. In particular, O^{15}, and F^{17}, for which the Gamow-Teller matrix elements are considered the most reliable because the magnetic moments of the daughter nuclei are especially close to the Schmidt limits, lead to a value for C_{GT}^2/C_F^2 of 1.16 ± 0.05. These results are consistent with recent theoretical considerations which suggest that meson exchange effects may give rise to appreciable corrections in the calculation of the matrix elements. (auth)

20544

ANALYSIS OF PHOTONUCLEAR CROSS SECTIONS. A. S. Penfold (Univ. of Chicago) and J. E. Leiss (National Bureau of Standards, Washington, D. C.). Phys. Rev. 114, 1332-7(1959) June 1.

The problem of obtaining a photonuclear cross section from a yield curve measured with a bremsstrahlung beam is discussed. The method fully sets forth the relationship between the average values for $\Omega(k)$ which are obtained and the true values. (auth)

20545

POLARIZATION OF 6- AND 7-MEV PROTONS ELASTICALLY SCATTERED BY NUCLEI. Robert E. Warner and W. Parker Alford (Univ. of Rochester, N. Y.). Phys. Rev. 114, 1338-44(1959) June 1.

Polarization measurements have been made by first scattering from the target of interest and second scattering in a carbon polarimeter for which the mean second scattering angle is 48° and for which the mean value of the polarization is greater than +70% for 5 Mev $\leq E_2 \leq$ 6 Mev. The polarization as a function of angle at 15° intervals from 45° to 135° is reported near 6 Mev for Al, Ti, V, Cr, Fe, Co, Ni, Cu, and Zn, and near 7 Mev for Al, Fe, Ni, and Cu. $P(\theta)$ usually shows an oscillatory behavior, with the magnitude of the maxima and minima never greater than about 40%. The polarization as a function of energy is reported for C at 45° from 5.7 to 6.8 Mev, and for Fe and Cu at 60° and 120° from 5.8 to 6.4 Mev. For C, P(45°) decreases from +92% at 5.7 Mev to +36% at 6.8 Mev. For Cu, P(60°) and P(120°) vary slowly, if at all, with energy, but a rapid energy variation for Fe is observed, possibly due to resonance effects in compound elastic scattering. (auth)

20546

DECAY OF $I^{130} \rightarrow Xe^{130}$. W. G. Smith, P. H. Stelson, and F. K. McGowan (Oak Ridge National Lab., Tenn.). Phys. Rev. 114, 1345-50(1959) June 1.

The decay of I^{130} has been previously studied by two groups of workers, and, as a result, the following level scheme for Xe^{130} has been proposed: 528 kev (2^+), 1190 kev (4^+), 1930 kev (6^+), and 2340 kev (5^-). Only the states at 1930 kev and 2340 kev were found to be directly populated by beta decay. However, the recent measurement of spin 5 for I^{130} suggests that the 1190-kev state, if 4^+, should be populated by beta decay. In the present work, such a group was looked for and not found. A lower limit of 9.8 was set for the log ft. Gamma-gamma correlations were also measured. The experimental correlation for 1190-528-0 level sequence can be fitted by 4(Q)2(Q)0 or by 2(96%D + 4%Q)2(Q)0 sequences. The 2^+ assignment to the 1190-kev level requires a predominantly M1 transition for the 2^+ to 2^+ transition in contrast to the predominantly E2 character of other known transitions of this type. Therefore, either 4^+ or 2^+ assignment to the 1190-kev state leads to an anomalous situation. Six other angular correlations were measured in an attempt to determine the characteristics of the levels at 1930 kev and 2340 kev. It was not possible to obtain unique assignments. (auth)

20547

PRECISE DETERMINATION OF THE U^{233} FISSION NEUTRON SPECTRUM. A. B. Smith, P. R. Fields, and R. K. Sjoblom (Argonne National Lab., Lemont, Ill.). and J. H. Roberts (Northwestern Univ., Evanston, Ill.). Phys. Rev. 114, 1351-3(1959) June 1.

The U^{233} prompt fission neutron spectrum is meas-

ured. Fast time of flight techniques are employed to study the neutron energy distribution from 0.3 to 5.0 Mev. Proton recoil emulsions are utilized for neutron measurements from 1.2 to 7.0 Mev. The average energy of the U^{233} prompt fission neutrons calculated from the experimental results is 1.87 ± 0.04 Mev. (auth)

20548

LIFETIME OF THE 3.56-Mev STATE IN Li^6. R. J. A. Levesque and S. M. Shafroth (Northwestern Univ., Evanston, Ill.). Phys. Rev. 114, 1354-7(1959) June 1.

An upper limit for the mean life of the 3.56-Mev state in Li^6 of 5×10^{-14} sec has been established by a Doppler shift method. This supports the 0^+, T = 1 assignment for this level. It has also been established by a Doppler shift technique that the angular distribution of the recoil alphas arising from the $Be^9(p,\alpha)Li^{6*}(\gamma)Li^6$ reaction is symmetric about 90° in the center-of-mass system at the resonant bombarding energy of 2.56 Mev. At 2.93-Mev bombarding energy the angular distribution of the alphas is peaked forward of 90°. (auth)

20549

NOTE ON THE PHOTODISINTEGRATION OF THE DEUTERON. W. Zernik, M. L. Rustgi, and G. Breit (Yale Univ., New Haven). Phys. Rev. 114, 1358-60(1959) June 1.

The differential cross section $\sigma(\theta,\varphi)$ and proton polarization $P(\theta,\varphi)$ have been computed at γ-ray energies of 22.5, 32.8, 64.4, 107.8, 164.5, and 193.9 Mev. The nuclear force potential was a slightly modified form of that used by Signell and Marshak. In order to test recent claims regarding comparison with experiment not calling for the inclusion of effects of retardation and exchange currents, these effects have been neglected. The influence of the inclusion of different multipoles has been studied by employing successive approximations in which the transitions which are unimportant at low energies are introduced in turn. The inclusion of M1 transitions to triplets and of E2 effects has left discrepancies of several times the experimental error with data on σ at 65 and 108 Mev. The relative largeness of the effects of the transitions just mentioned at the higher energies complicates the employment of the photoeffect as a means of obtaining evidence regarding the nucleon-nucleon interaction. (auth)

20550

ELASTIC PROTON-DEUTERON SCATTERING AT 450 Mev. A. V. Crewe, B. Ledley, E. Lillethun, S. Marcowitz, and L. G. Pondrom (Univ. of Chicago). Phys. Rev. 114, 1361-5(1959) June 1.

The elastic scattering cross section for 450-Mev protons by deuterons has been measured for proton center-of-mass scattering angles from 16.45° to 127°. The scattered protons (or recoil deuterons) were analyzed by a magnet and detected by a scintillation counter telescope. The cross sections have been normalized by using published p-p cross sections. The sticking factor has been calculated for two deuteron potentials using the impulse approximation. This analysis indicates that there may be destructive interference between the n-p and p-p scattering in the deuteron at this energy. (auth)

20551

OBSERVATION OF NUCLEAR RESONANCE IN A FERROMAGNET. A. C. Gossard and A. M. Portis. (Univ. of California, Berkeley). Phys. Rev. Letters 3, 164-6(1959) Aug. 15.

A strong resonance was detected at room temperature in a sample of finely divided face-centered-cubic cobalt (Co^{59}) metal. The resonance frequency was measured to be 213.1 Mc/sec in zero applied field. The observed frequency indicates a magnetic field of 213,400 oersteds at the site of the cobalt nuclei. This very sizeable magnetic field arises from both core and conduction electron contributions. (auth)

20552

PROTON CAPTURE GAMMA RAYS IN THE GIANT RESONANCE REGION. H. E. Gove, A. E. Litherland, and R. Batchelor (Atomic Energy of Canada Ltd., Chalk River, Ont., Can.). Phys. Rev. Letters 3, 177-9(1959) Aug. 15.

Measurements of the 90° yield of gamma rays resulting from proton capture, at energies up to 11 Mev, in B^{11} and Al^{27} were made. In both cases the gamma rays investigated were those leading to the ground and first excited states (4.43 and 1.78) of the residual nuclei, C^{12} and S^{28}. The results of the $B^{11}(p,\gamma)C^{12}$ reaction are reported principally. Gamma rays were detected in a 5-inch diameter by 6-inch long unshielded NaI(Tl) crystal. (W.D.M.)

20553

NEUTRON ASYMMETRY FROM Mu CAPTURE IN MAGNESIUM. W. F. Baker and C. Rubbia (Columbia Univ., New York). Phys. Rev. Letters 3, 179-81(1959) Aug. 15.

It has previously been pointed out that a measurement of the angular distribution of neutrons emitted after the capture of polarized μ^- mesons by complex nuclei may give information on the nature of the coupling constants in the process $\mu^- + p \rightarrow n + \nu$. A spatial asymmetry with respect to the μ spin direction would also be evidence for parity nonconservation in the reaction. The neutron asymmetry was measured by processing the negative muons stopped in a magnesium target through 90° by a constant magnetic field which was reversed every 30 min. (W.D.M.)

20554

LONGITUDINAL POLARISATION OF BETA PARTICLES FROM Rb^{86}, Pr^{144}, AND Co^{60}. M. C. Joshi, V. G. Kulkarni, C. V. Panat, and B. V. Thosar (Tata Inst. of Fundamental Research, Bombay). Proc. Indian Acad. Sci., Sec. A 49, p.322-5(1959) June.

An experimental set up is described for converting longitudinal polarization of beta particles to transverse polarization and for determining the degree of polarization, using the method of Mott scattering from a thin gold foil. Electron polarization in the energy range 90 to 150 kev can be studied. The degree of polarization for beta particles of energy 110 kev from Co^{60}, Pr^{144}, and Rb^{86} has been determined and is seen to be equal to $-v/c$, within the limits of experimental error. (auth)

20555

THE BINDING ENERGY OF HELIUM NUCLEUS. M. H. Wang and H. L. Tsao (Chekiang Univ., China). Sci. Record (China) 3, 112-19(1959) Mar.

The present calculation on the binding energy of the He^4 nucleus is a part of the work in attempting to solve the "consistency" problem of light nuclei. The variational method is used. The trial wave function contains fourteen terms and fifteen variable parameters. These terms are mutually independent and form a complete set of S-, P-, and D-waves up to the fourth order of approximation. Phenomenological two-body interaction with central and tensor forces is assumed. Four sets of potential parameters, namely, one set of Feshbach-Schwinger, the first set of Pease-Feshbach, the second set of Pease-Feshbach, and the set of Hu-Hsu, are used in turn. The results of the calculations are: the theo-

retical value of the binding energy of the He^4 nucleus from the first two sets of potential parameters mentioned above is larger than the observed value, that from the second set of Pease-Feshbach is 26.4 Mev and that from the set of Hu-Hsu is 10.3 Mev. These results show that up to the 4th order of approximation there exists a two-body interaction with central and tensor forces and with the potential parameters near to those given by the second set of Pease-Feshbach capable of solving the "consistency" problem of the light nuclei. (auth)

20556

IONIZATION IN ION INTERACTIONS WITH ATOMS. N. V. Fedorenko. Uspekhi Fiz. Nauk 68, 481-511(1959) July. (In Russian)

A review is given of experimental data on the ionization of atoms by ions in kev and ev energy ranges. The capture of electrons is discussed only in relation to the complex ionization and capture processes in which the processes are too involved for differential analysis. General data are given on complete ionization cross sections and on the correlation of empirical solutions with existing theoretical concepts. Investigations of ionization with the escape of several electrons, scattering in collisions with ionization, and single interactions of singly charged ions with atoms and gas molecules are discussed. 68 references. (R.V.J.)

20557

ANGULAR DISTRIBUTION OF FISSION FRAGMENTS PRODUCED BY HEAVY IONS. V. A. Druin, Yu. V. Lobanov, and S. M. Polikanov. Zhur. Eksptl'. i Teoret. Fiz. 37, 38-40(1959) July. (In Russian)

The ratio of the yield of fission fragments emitted at angles of 135 and 90° during fission of gold nuclei induced by carbon and oxygen ions and also of the products of fission of U^{238} induced by carbon ions was measured. The ranges of the fission products were also measured. The experimental anisotropy coefficient of the fragments is compared with the theoretical values deduced on the basis of the statistical theory. (auth)

20558

THORIUM FISSION INDUCED BY THERMAL NEUTRONS. E. I. Korneev, V. S. Skobkin, and G. N. Flerov. Zhur. Eksptl'. i Teoret. Fiz. 37, 41-5(1959) July. (In Russian)

It is shown that the fission effect which occurs when thorium is irradiated with slow neutrons is in fact due to fission of Th^{232} by thermal neutrons. The fission cross section is (0.06 ± 0.02) mb. The results obtained are compared with available experimental data relating to fission of even-even nuclei by thermal neutrons. (auth)

20559

MEASUREMENT OF THE POLARIZATION OF DEUTERONS PRODUCED BY 670 Mev PROTONS IN THE $p + p \rightarrow d + \pi^+$ REACTION. Yu. K. Akimov, K. S. Marish, O. V. Savchenko, and L. M. Soroko (Joint Inst. of Nuclear Studies, Dubna, U.S.S.R.). Zhur. Eksptl'. i Teoret. Fiz. 37, 46-53(1959) July. (In Russian)

The vector polarization of deuterons produced in the $p + p \rightarrow d + \pi^+$ reaction was measured for 670-Mev protons at angles of 121°, 140°30′, and 162° in the c.m.s. The amplitude of the non-resonance $^1S_0 \rightarrow {}^3S_1\, p_0\, p$ transition was determined. The contribution of this transition to the total cross section is approximately 1%. The measured angular dependence of the deuteron vector polarization is not inconsistent with the assumption that the transition amplitudes from initial $^3F_2$ and $^3F_3$ states of two protons are zero. (auth)

20560

(d,t) REACTIONS ON Li^6, Li^7 AND Be^9 NUCLEI. N. A. Vlasov and A. A. Ogloblin. Zhur. Eksptl'. i Teoret. Fiz. 37, 54-61(1959) July. (In Russian)

The spectra of tritons emitted at various angles in the (d,t) reaction on Li^6, Li^7, and Be^9 were studied for 20-Mev deuterons. The probability of formation of excited states in the final nucleus sharply decreases with increase of the excitation energy. Angular distributions were obtained for triton groups corresponding to the formation of Li^5 in the ground state, Li^6 in the ground and in the first two excited states, and Be^8 in the ground and in the first excited state. The angular distributions are in good agreement with those computed from the Butler formula for the (d,t) reaction but the radius increases with the level energy. (auth)

20561

ON THE ANALYTICAL PROPERTIES OF THE VERTEX PARTS IN QUANTUM FIELD THEORY. L. D. Landau (Inst. of Physical Problems, Academy of Sciences, S.S.S.R.). Zhur. Eksptl'. i Teoret. Fiz. 37, 62-70(1959) July. (In Russian)

A general method is developed, based on the diagrammatic technique, for determination of singularities in the quantum field theory quantities. (auth)

20562

ON THE EXCITATION OF VIBRATIONAL AND ROTATIONAL STATES OF NUCLEI IN THE SCATTERING OF CHARGED PARTICLES. E. A. Romanovskii (Inst. of Nuclear Physics, Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 37, 82-91(1959) July. (In Russian)

A semi-classical method is presented for the calculation of vibrational and rotational states of nuclei due to the interaction of scattered charged particles with the surface of the target nucleus. (auth)

20563

INELASTIC SCATTERING OF NUCLEONS ON Mg^{24} AND Si^{28} NUCLEI. V. I. Mamasakhlisov and T. I. Kopaleishvili (Inst. of Physics, Academy of Sciences, Georgian S.S.R.). Zhur. Eksptl'. i Teoret. Fiz. 37, 133-6(1959) July. (In Russian).

Inelastic scattering of nucleons on Mg^{24} and Si^{28} nuclei is investigated with consideration of coulomb interaction for the cases of excitation of collective nuclear levels and single-particle excitation in the field of a deformed nucleus. The relation between the nature of the angular distribution and magnitude of the effective cross section on the one hand and the magnitude and sign of the deformation on the other is analyzed. (auth)

20564

INTENSITY RULES FOR β TRANSITIONS TO VARIOUS ROTATIONAL STATES OF DAUGHTER EVEN-EVEN NUCLEI. A. S. Davydov (Lebedev Inst. of Physics, Academy of Sciences, S.S.S.R.). Zhur. Eksptl'. i Teoret. Fiz. 37, 137-42(1959) July.

Relative probabilities of β decay of an odd-odd nucleus with excitation of various rotational states of the daughter nonaxial even-even nucleus are computed. The theory is compared with the experiments in the case of β decay of Re^{186}, Np^{238}, Eu^{154}, Re^{190}, and Ir^{190} nuclei. (auth)

20565

ON μ^--MESON CAPTURE BY LIGHT NUCLEI. B. L. Ioffe (Inst. of Theoretical and Experimental Physics, Academy of Sciences, S.S.S.R.). Zhur. Eksptl'. i Teoret. Fiz. 37, 159-63(1959) July. (In Russian)

Various effects appearing during the capture of μ^- mesons by light nuclei not accompanied by proton or neutron emission are investigated. The interaction is assumed to consist of A and V coupling. Corrections in the first order in nucleon velocity and $(R/\lambda)^2$ are applied and found to be quite appreciable. Besides the usual matrix elements the result of the calculations contains one unknown constant so that at least two experiments are required in order to verify the theory. (auth)

20566

DECAY PROCESSES IN THE DEVELOPMENT OF NUCLEAR CASCADES IN THE ATMOSPHERE. G. T. Zatsepin, S. I. Nikol'sii, and A. A. Pomanskii (Lebedev Inst. of Physics, Academy of Sciences, S.S.S.R.). Zhur. Eksptl'. i Teoret. Fiz. 37, 197-201(1959) July. (In Russian)

A general method is presented for the solution of the equations describing the nuclear cascade process in the atmosphere for initial conditions prescribed at an arbitrary depth. The fraction of energy expended by nuclear cascade showers as a result of $\pi \rightarrow \mu + \nu$ decay is estimated. (auth)

20567

OPTICAL ANISOTROPY OF ATOMIC NUCLEI. A. M. Baldin (Lebedev Inst. of Physics, Academy of Sciences, S.S.S.R.). Zhur. Eksptl'. i Teoret. Fiz. 37, 202-11 (1959) July. (In Russian)

Concepts of molecular optics are extended to photonuclear reactions. The consequences of the existence (of a hitherto experimentally unknown) tensor polarizability of atomic nuclei are discussed. Various tensor polarizability models are considered and estimates are made of the magnitude of the effects which one might hope to observe with account of the status of present day experimental techniques. (auth)

20568

ANGULAR AND POLARIZATION ANALYSIS OF REACTIONS OF THE $a + b \rightarrow a' + b' + c'$ TYPE. V. I. Ritus (Lebedev Inst. of Physics, Academy of Sciences, S.S.S.R.). Zhur. Eksptl'. i Teoret. Fiz. 37, 217-23(1959) July. (In Russian)

An investigation is carried out of the invariant angular operators into which the scattering matrix can be expanded for reactions of the $a + b \rightarrow a' + b' + c'$ type; these operators are convenient for the angular and polarization analysis of such reactions. Angular operators are derived in the explicit form for reactions in which the spin of the system does not exceed unity and also for similar reactions involving γ quanta. (auth)

20569

SUPERFLUIDITY AND THE MOMENTS OF INERTIA OF NUCLEI. A. B. Migdal. Zhur. Eksptl'. i Teoret. Fiz. 37, 249-63(1959) July. (In Russian)

A method for treatment of superfluidity of nuclei is developed. A formula for the moments of inertia of nuclei is obtained which agrees satisfactorily with the experimental data. An expression for the change in the pairing energy involved in the transition from an even-even to an even-odd nucleus and also for the relevant change of the moment of inertia was obtained. (auth)

20570

CONCERNING THE CAPTURE OF K^- MESONS. D. K. Kopylova, Yu. B. Korolevich, N. I. Petukhova, and M. I. Podgoretskii (Joint Inst. of Nuclear Studies, Dubna, U.S.S.R.). Zhur. Eksptl'. i Teoret. Fiz. 37, 289-91 (1959) July. (In Russian)

The mechanism of the capture by nuclei of K mesons stopped in a photoemulsion is discussed. Under the assumption of the surface model of single nucleon absorption, the part of the two nucleon capture is estimated as ~30%. (auth)

20571

ANGULAR CORRELATION CONSIDERING SCREENING AND FINITE SIZE OF NUCLEUS IN INTERNAL CONVERSION. A. K. Ustinova. Zhur. Eksptl'. i Teoret. Fiz. 37, 307-9(1959) July. (In Russian)

20572

DECAY OF Te^{131} ($T_{1/2}$ = 30 HOURS). A. Bedesku, K. P. Mitrofanov, A. A. Sorokin, and V. S. Shpinel (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 37, 314-15 (1959) July. (In Russian)

The scheme of I^{131} lower levels excited by Te^{131} isomer ($T_{1/2}$ = 30 hours) was verified, and some new data are found for γ transitions. (R.V.J.)

20573

A POSSIBLE METHOD FOR IDENTIFYING NEW TRANSURANIUM ELEMENTS. V. I. Gol'danskii and M. I. Podgoretskiĭ (Joint Inst. of Nuclear Research, Dubna, U.S.S.R.). Zhur. Eksptl'. i Teoret. Fiz. 37, 315-17(1959) July. (In Russian)

A simple method is suggested for determining the genetic bond between the mother isotope A and a longer lived daughter isotope B, based on measurements of the time interval between two adjoining decays B and B(τ_{BB}) and between the A decay and its close decays B(τ_{AB}). When A and B decays occur independently, the mean duration of τ_{AB}, which is the interval between the adjoining decays A and B, should be identical to the mean duration τ_{BB} of the adjoining B decays. In the event any part of the observed B decays is specified by preceding A decays, the τ_{AB} should be smaller than τ_{BB}. The latter condition represents the principle of the method. (R.V.J.)

20574

ATLAS OF γ-RAY SPECTRA FROM RADIATIVE CAPTURE OF THERMAL NEUTRONS. L. V. Groshev, A. M. Demidov, V. N. Lutsenko, and V. I. Pelekhov. Translated from the Russian by J. B. Sykes. International Series of Monographs on Nuclear Energy. Division IV. Isotopes and Radiation. Volume 1. New York, Pergamon Press, 1959. 201p. $20.00.

Details of the gamma spectra which are emitted following the capture of thermal neutrons in 50 elements are presented in tabular and graphical form. Details of the level schemes which can be deducted from the experimental results are given. Gamma spectra of 19 elements which have recently been obtained with the Compton spectrometer are included. Appendices contain conversion electron data. (W.D.M.)

Theory

20575

EXCITATION OF OSCILLATIONS IN A PLASMA LAYER. Masao Sumi (Electrical Communication Lab., Tokyo). J. Phys. Soc. Japan 14, 1093-7(1959) Aug.

Theory of excitation of standing waves in a uniform plasma layer by an injected electron beam is presented. Various characteristics of excited waves are investigated; in particular, discontinuous jumps of frequency and mode can be expected with the variation of electron density, layer thickness, and beam voltage. The consequences of the theory are compared with experimental

results. It is seen that observed phenomena concerning standing plasma waves are satisfactorily illustrated in a quite natural way. (auth)

20576

THEORY OF DIRECT-INTERACTION INELASTIC SCATTERING. Norman K. Glendenning (Univ. of California, Berkeley). Phys. Rev. 114, 1297-1311(1959) June 1.

A model is proposed for the description of direct-interaction inelastic scattering in which resolved final states of the target nucleus are observed. This model is expected to be useful in deducing the spins and parities of the excited states of nuclei. (auth)

20577

SECOND FORBIDDEN COULOMB β TRANSITIONS. Yu. V. Gaponov (Inst. of Nuclear Physics, Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 37, 154-8(1959) July. (In Russian)

By classifying the terms appearing in the expansion of the β-interaction Hamiltonian in a series, rules were obtained which permit one to predict which nuclear matrix elements contribute to a given type of β transition and also to estimate them. It is demonstrated that a simple second forbidden Coulomb β transition $\Delta j = 2$ (no) exists, which is similar in its properties to unique β transitions. The angular $\beta-\nu$ correlation and $\beta-\gamma$ correlation with circularly polarized γ quanta and also the spectrum were derived for this transition. (auth)

20578

ON THE LAGRANGIAN FORMALISM FOR SPIN VARIABLES. D. V. Volkov and S. V. Peletminskii (Inst. of Physics and Tech., Academy of Sciences, Ukrainian S.S.R.). Zhur. Eksptl'. i Teoret. Fiz. 37, 170-8(1959) July. (In Russian)

It is demonstrated that a modification of the class of permissible variations in the Schwinger variational principle permits one to include spin variables in the general Lagrangian formalism in the nonrelativistic as well as relativistic cases. (auth)

20579

ON CALCULATION OF THE COUPLING CONSTANTS IN THE NONLINEAR THEORY. Ya. I. Granovskii (Inst. of Nuclear Physics, Academy of Sciences, Kazakh S.S.R.). Zhur. Eksptl'. i Teoret. Fiz. 37, 192-6(1959) July. (In Russian)

The coupling constant is expressed through the proton mass in the second approximation of the Tamm–Dankoff theory. The formulas thus obtained can be applied if the Lagrangian is an arbitrary linear combination of five fundamental invariants. (auth)

20580

DYNAMICS OF A CONDUCTING GASEOUS SPHERE IN A QUASI-STATIONARY ELECTROMAGNETIC FIELD. V. V. Yankov (Lebedev Inst. of Physics, Academy of Sciences, S.S.S.R.). Zhur. Eksptl'. i Teoret. Fiz. 37, 224-8(1959) July. (In Russian)

Small oscillations of an infinitely conducting plasmic sphere in a quasi-stationary homogeneous electromagnetic field are investigated. (auth)

20581

PASSAGE OF PARTICLES THROUGH A PLASMA. A. I. Larkin. Zhur. Eksptl'. i Teoret. Fiz. 37, 264-72 (1959) July. (In Russian)

The Green function method and the graph technique are employed to calculate the energy loss per unit time of a particle passing through a plasma. Numerical values of the factors in the argument of the logarithm were obtained for limiting cases. (auth)

RADIATION EFFECTS ON MATERIALS

20582 AD-209698

Chatham Electronics, Div. of Tung-Sol Electric Co., Livingston, N. J.

DEVELOPMENT AND EVALUATION OF ELECTRON TUBE GLASSES RESISTANT TO RADIATION DAMAGE. Semi-annual Progress Report No. 1 [for] Period: May 1 to November 1, 1958. 23p. DA Project No. 3-99-00-100. Contract DA-36-039-SC-75065.

Objectives of the program are to investigate effects of radiation on known soft and hard glasses used in electron tubes and to develop and evaluate suitable glasses which will withstand certain radiation levels without damage. Dummy bulbs of G8, G12, 7720, and 7052 glass were exposed to a neutron bombardment of an integrated thermal flux of 1016 nvt. Enclosures using the same glasses were made with lead-in wires sealed-in. (W.D.M.)

20583 AECU-4300

Stanford Research Inst., Menlo Park, Calif.

RADIATION STABILITY OF ORGANIC LIQUIDS. Semi-Annual Report No. 5 for Period January 1 to June 30, 1959. R. M. Wagner and L. H. Towle. July 3, 1959. 26p. SRI Project No. SD-2080. For Oak Ridge National Lab. Contract W-7405-eng-26, Subcontract 1081. $4.80(ph), $2.70(mf) OTS.

The research conducted during this period was concerned with the degree of protection conferred upon TBP by certain organic additives in the Amsco diluent, the nature and degree of damage to TBP when exposed simultaneously to both 12 N nitric acid and radiation (100 or 400 whr/liter), irradiation of di-sec-butyl phenylphosphonate and dilutions of this compound in o-xylene–Amsco, studies of the efficiency of acidic species extraction from TBP with various caustic solutions, development of an acceptable method for the codetermination of nitric acid and DBP in TBP–Amsco systems, and the irradiation of N-benzyl-1-nonyl decyl amine and N-benzyl-1-undecyl dodecyl amine to 400 whr/liter levels. These six groups of studies are summarized in detail and the salient results are noted for each group. (auth)

20584 CF-59-1-90(Rev.)

Oak Ridge National Lab., Tenn.

SOME EFFECTS OF RADIATION ON SOLVENT EXTRACTION PROCESSES. Wallace Davis, Jr., and Robert M. Wagner. Jan. 26, 1959. 14p. Contract [W-7405-eng-26]. $3.30(ph), $2.40(mf) OTS.

Presented at the 135th National Meeting of the A.C.S., Boston, April 5-10, 1959.

The yield of total acid, G_{acid}, in the radiolysis of tributyl phosphate–Amsco 125-82 solutions is 2.7 times the electron fraction of TBP, or approximately 2.7 times the weight fraction of TBP, per 100 ev of energy absorbed by the solution. Dibutyl phosphoric acid, DBPA, constitutes about 85% of the acid. Radiolysis of TBP also results in the conversion of about 0.9 molecules of TBP to a polymer per 100 ev of energy absorbed. Uranium extraction-stripping tests with an 8 stage spinner column have shown that one mole of

uranium is retained in the organic phase during the stripping operation per mole of DBPA added prior to the extraction operation. This is at least twice as much uranium as would be expected on the basis of a compound of the composition $UO_2(DBP)_2$. On the basis of a tentative molecular weight of 843 g/mole, the polymer retains in the organic phase during stripping operations about 1.2 moles of uranium per mole of polymer added prior to extraction. In addition to polymer and acids, condensed phase radiolysis products include olefins, whose yield, expressed as $G_{C=C}$, or number of double bonds formed per 100 ev of energy absorbed, decreases from ca 4 to 1 as the TBP concentration increases from 4.5 to 100 wt. %. Among newer extractants being examined for use in radiochemical reprocessing, diethyl carbonate, DEC, has been tested for uranium retention and fission product decontamination properties. After irradiation to the 400 watt-hr/liter level, the uranium retention by DEC on stripping is decreased, rather than increased. Although γ-decontamination was adversely affected, β-decontamination was essentially unaffected by irradiation to this level. (auth)

20585 D2-2123
Boeing Airplane Co., Seattle.
EFFECTS OF CONTINUOUS GAMMA RAY OR PULSED NEUTRON RADIATION ON SEMICONDUCTOR DIODES. Howard L. Steele. Oct. 8, 1958. 39p.

Ten different diode types were exposed to continuous gamma radiation and neutron pulses plus gamma radiation. It was found that the permanent change in the reverse characteristic of a diode, which is encapsulated in a liquid, could cause malfunctions in a critical circuit if it were subjected to conditions similar to those in the test. The gas-encapsulated diode is more stable for such a circuit. Neutron effects were about 1000 times greater than gamma-ray effects on semiconductor forward characteristics but the effects on reverse characteristics were about equal. There was no measurable change in the forward characteristic at the dose rates studied. (J.R.D.)

20586 NARF-59-28T
Convair, Fort Worth, Tex.
MECHANISMS OF RADIATION DAMAGE. A Series of Lectures. June 15, 1959. 353p. Project 6(1-9964). Contract AF33(600)-32054. (MR-N-232).

A summary of information contained in a series of 15 lectures on damage in irradiated materials is presented. A discussion is given on the specification of reactor flux spectra. Emphasis is placed on the importance of accurate flux specifications in reliable predictions of rates of production in neutron-induced defects in materials. Atomic displacements produced in solids by neutron bombardment are discussed. Displacement mechanisms, such as thermal spikes, displacement spikes, replacement collision, and the Silsbee effect, are considered. An interpretation of slip in crystals on the basis of dislocation theory is given. Kinds of slip, such as easy glide and parabolic work hardening, are discussed. Theoretical explanations of hardening techniques are given. Stresses around temperature spikes, generation of dislocation rings by radiation, persistence of rings, and the possibility of radiation-induced disordering in alloys are discussed. Structure, nomenclature, chemical and physical properties of organic compounds are discussed with emphasis on compounds of interest to radiation damage study and the aircraft industry. Preparation of polymers, resins, structure of plastics, polymerization mechanisms, nomenclature, and application aspects of the more important polymers are examined. A general discussion of radiation studies made in the past few years at various facilities concerning irradiation of organics is presented. A discussion of radiation damage mechanisms in polymers is given. Damage mechanisms, such as cross linking, gas evolution, end-linking, free-radical mechanisms, ionization processes, rearrangements, and chain scission, are considered. A discussion of silanes, silicates and siloxanes, is followed by a treatment of the chemistry of the silicon-carbon bond. General characteristics, molecular forces, structure, physical properties, and behavior of polymer systems are discussed. Rheological methods of correlating radiation-induced changes in physical properties of elastomers with mechanisms occurring on the molecular level are discussed. Various types of anti-rad materials are discussed and their applicability in organic materials is considered. General rules are given regarding the stability of organic compounds and some predictions of radiation stability in organic systems are made. (auth)

20587 NP-7855
Battelle Memorial Inst., Columbus, Ohio.
RADIATION DAMAGE STUDY OF ELECTRONIC COMPONENTS. Final Report. R. G. Jung, J. N. Anno, and J. W. Chastain. Mar. 5, 1959. 38p.

The effects of radiation on several electronic components used in aircraft instrumentation were studied. The components were airspeed and altitude transmitters, synchrotel data transmitters, control transformers, resolvers, linear generators, and thermistors. Each component was irradiated to an integrated total fast-neutron flux of 10^{16} n/cm^2 with an associated total gamma dose of 10^8 rep. The operation of the components was monitored before, during, and after irradiation. The postirradiation studies were performed for a 100-hr period immediately after irradiation and then for an additional 50 hr following a 2-week rest period. The operation of the altitude transmitters, resolvers, linear generators, and thermistors showed no effects of damage. The remaining components suffered slight to moderate damage. The damage generally resulted in binding or insulation breakdown. (auth)

20588 NYO-7966
Carnegie Inst. of Tech., Pittsburgh.
IRRADIATION-INDUCED CHANGES IN MAGNETIC SUSCEPTIBILITY OF COPPER–NICKEL ALLOYS (thesis). Frederick Merk Ryan. Dec. 6, 1958. 79p. Contract AT(30-1)-1828. $12.30(ph), $4.50(mf) OTS.

The effect of neutron irradiation on copper–nickel alloys was investigated by means of magnetic susceptibility measurements. The susceptibilities were measured by the Gouy method at 300 to 2.0°K for a series of alloys ranging from 17.22 to 46.5 at.% nickel. The samples were exposed to neutron fluxes ranging up to 2.2×10^{19} neutrons/cm^2 while at 80°C and the magnetic susceptibilities were found to increase following the irradiation. The increase was greatest for the samples with the highest nickel content and neutron fluxes. The increase was found to completely anneal in the temperature range at which the self-diffusion becomes an important mechanism. It is suggested that copper–nickel is not a perfectly random system and that the neutron irradiation enhances diffusion toward a true equilibrium at room temperature. (auth)

20589 SC-4046-B(M)
Sandia Corp., Albuquerque, N. Mex.
UNCLASSIFIED PORTION OF RADIATION EFFECTS BIBLIOGRAPHY. S. T. Landrith, comp. Dec. 1, 1958. 101p. Contract AT-(29-1)-789. $15.30(ph), $5.40(mf) OTS. Supersedes SC-4046A(M).

A bibliography is presented of all unclassified documents and all photostats of periodical literature collected in the Radiation Effects Program File of the Radiation Effects Section. Approximately 1600 references. (D.E.B.)

20590 SCR-79
Sandia Corp., Albuquerque, N. Mex.
RADIATION-INDUCED COLORATION IN GLASS. W. H. Cropper. Aug. 1959. 17p. $3.30(ph), $2.40 (mf) OTS.

General aspects of radiation-induced coloration in glass are discussed. It is considered that the most significant initial effect of the radiation is to produce free electrons and positive holes in a track. The decay of the track from the initial condition is described in some detail, assuming that the rate of diffusion of electrons from the track is small compared to the rates of other processes, and that "primary" processes which form color centers can be considered independent of "secondary" processes which cause destruction of color centers. A method of calculation is described which gives the concentration of color centers formed at various doses. With plausible assumptions for the parameters, agreement with the data of Schulman on a silver phosphate glass is obtained. The treatment of glasses less simple than the silver phosphate case is also discussed. (auth)

20591
PROCESSING MATERIALS WITH ELECTRON BOMBARDMENT. Alan Lawley (Univ. of Pennsylvania, Philadelphia). Electronics 32, No. 36, 39-4(1959) Sept. 4.

New techniques in the use of electron beams to give metals and insulating materials better qualities such as purity, high-temperature stability, and strength are discussed. A description of the electron-bombardment unit and its control is given. Electron-beam melting and electron-beam welding techniques are discussed. (C.J.G.)

20592
RADIATION EFFECTS IN MATERIALS. Harvey Brooks (Harvard Univ., Cambridge). J. Appl. Phys. 30, 1118-24(1959) Aug.

A review is given of the mechanisms of radiation damage, and of some of the resulting effects. The discussion is divided into three categories: mechanisms of damage production, nature and mobility of the imperfections produced, and effect of the imperfections on the measurement of the properties of the solid. Principal attention is given to metals, with related observations in semiconductors cited. (auth)

20593
INFRARED ABSORPTION AND PHOTOCONDUCTIVITY IN IRRADIATED SILICON. H. Y. Fan and A. K. Ramdas (Purdue Univ., Lafayette, Ind.). J. Appl. Phys. 30, 1127-34(1959) Aug.

The effects of irradiation on the infrared absorption and photoconductivity in silicon are reported. The absorption near the intrinsic edge is increased and drops off more gradually toward longer wavelengths. Several absorption bands are introduced by neutron irradiation with peak absorptions at 1.8, 3.3, 3.9, 5.5, and 6.0 μ, respectively. The observation of each band depends upon the position of the Fermi level. The 1.8 μ band has also been studied for deuteron irradiated and electron irradiated silicon, and the 3.3 μ band has been observed in electron irradiated samples. The absorption bands arise from electronic excitations of various types of defects and associated photoconductivity has been observed for the 3.9 μ and 5.5 μ bands. In addition absorption bands have been observed at long wavelengths: 20.5, 27.0, and 30.1 μ, which are associated with lattice vibration. The significance of these results is discussed. (auth)

20594
RADIATION EFFECTS IN SEMICONDUCTORS: THERMAL CONDUCTIVITY AND THERMOELECTRIC POWER. T. H. Geballe (Bell Telephone Labs., Inc., Murray Hill, N. J.). J. Appl. Phys. 30, 1153-7(1959) Aug.

The use of thermal conduction and thermoelectric measurements in studying radiation damage effects in semiconductors is discussed. The conclusion is reached that in the present state of knowledge such measurements will probably be more helpful in studying the kinetics of the formation and annealing of radiation-introduced defects than in characterizing the structure of such defects. (auth)

20595
TRANSPORT PROPERTIES IN SILICON AND GALLIUM ARSENIDE. R. K. Willardson (Battelle Memorial Inst., Columbus, Ohio). J. Appl. Phys. 30, 1158-65(1959) Aug.

High-purity n- and p-type silicon has been irradiated lightly with Co^{60} γ rays. Analysis of the Hall mobility and magnetoresistance data indicate the introduction of levels near the conduction and valence bands. The analysis suggests the presence of triply ionized acceptors and singly ionized donors. The third ionization state of the acceptor apparently produces a level above the center of the band gap. Under more extensive irradiation a double ionization of the donors can account for the observed high resistivity. An initial increase in the magnetic field dependence of the Hall coefficient in both n- and p-type silicon may be related to the multiple ionization or to radiation annealing. The Hall mobility and transverse magnetoresistance in n-type gallium arsenide have been studied as a function of impurity concentration and density of defects introduced by fast-neutron irradiation. The change in the mobility and magnetoresistance with fast-neutron bombardment suggests the introduction of levels near the band edges and of multiply ionized levels similar to those in silicon. (auth)

20596
RECOMBINATION PROPERTIES OF BOMBARDMENT DEFECTS IN SEMICONDUCTORS. G. K. Wertheim (Bell Telephone Labs., Inc., Murray Hill, N. J.). J. Appl. Phys. 30, 1166-74(1959) Aug.

The theory of recombination via defects having energy levels in the forbidden gap is reviewed. Emphasis is given to those aspects which complicate interpretation of lifetime data, such as the inherent difference between steady state and transient measurements, large-signal behavior, competing recombination mechanisms, trapping, the possible existence of strongly temperature-dependent cross sections, and the properties of multilevel defects. A summary of the known recombination properties of bombardment-produced defects is given. (auth)

20597

RADIATION EFFECTS ON RECOMBINATION IN GERMANIUM. Orlie L. Curtis, Jr. (Oak Ridge National Lab., Tenn.). J. Appl. Phys. 30, 1174-80(1959) Aug.

The properties of recombination centers in germanium are obtained on the basis of lifetime data in conjunction with other information available. For recombination centers introduced by Co^{60} gamma rays and fission neutrons, the recombination energy level position is placed at 0.20 ev below the conduction band. The room temperature hole-capture cross sections resulting are 1.1×10^{-15} cm^2 and 6×10^{-15} cm^2 for Co^{60} gamma-ray and fission neutron irradiation, respectively. For the case of 14-Mev neutron irradiation the energy level is located 0.32 ev above the valence band. The room temperature hole and electron cross sections are $\sim 6 \times 10^{-15}$ cm^2 and 2.2×10^{-17} cm^2, respectively. The capture probabilities are assumed to be independent of temperature except for the case of gamma irradiation, for which there is apparently a fairly strong variation corresponding to a change in the activation energy of 0.07 ev. The selection of the values given above is not entirely unique. The assumptions made in their determination are discussed. The values given are directly applicable only in the case of n-type material, the situation in p-type material being more complex. (auth)

20598

ELECTRON-BOMBARDMENT INDUCED RECOMBINATION CENTERS IN GERMANIUM. J. J. Loferski and P. Rappaport (RCA Labs., Princeton, N. J.). J. Appl. Phys. 30, 1181-3(1959) Aug.

The rate of change of minority carrier lifetime in germanium crystals bombarded by 1-Mev electrons has been studied experimentally as a function of the initial resistivity of the material. Analysis of the data leads to the conclusion that a single recombination center controls lifetime in both n- and p-type material, that this level is located as either 0.21 ± 0.005 ev from the conduction band or else at 0.26 ± 0.005 ev from the valence band, and that the ratio of the cross section for capture of minority holes is 18 times the cross section for capture of minority electrons. The absolute value of the hole capture cross section is 4.5×10^{-15} cm^2 if one uses the best available data for the probability of producing a Frenkel defect by a 1-Mev electron. This large value is compared to the findings of other authors in similar experiments. (auth)

20599

MAGNETIC AND ELECTRICAL PROPERTIES OF REACTOR-IRRADIATED SILICON. E. Sonder (Oak Ridge National Lab., Tenn.). J. Appl. Phys. 30, 1186-94(1959) Aug.

Magnetic susceptibility measurements above 3°K and Hall effect and resistivity determinations between 50 and 300°K are reported for n-type silicon samples irradiated with increasingly higher doses of fission neutrons. The paramagnetism due to electronic states in the forbidden gap shows an initial decrease after short irradiation but a reversal, increase, and final saturation at a value less than that originally contributed to the paramagnetism by the filled donors after longer irradiation. The Hall coefficient shows evidence of a distribution of irradiation-produced energy levels in the neighborhood of 0.3 ev below the conduction band. The mobility goes through an initial sharp decrease with irradiation but recovers partially after longer irradiations. The results are discussed in terms of several models of radiation damage. It is concluded that a simple model based on uniformly dispersed interstitials and vacancies is not adequate to explain the results and that interactions between centers, and nonuniform distribution of damage will probably have to be taken into consideration. (auth)

20600

PARAMAGNETIC RESONANCE IN ELECTRON IRRADIATED SILICON. G. Bemski (Bell Telephone Labs., Murray Hill, N. J.). J. Appl. Phys. 30, 1195-8(1959) Aug.

Electron spin resonance has been observed in n-type silicon irradiated with 0.5-Mev electrons. The particular resonance lines discussed here appear only in pulled crystals which contain about 10^{18} oxygen atoms per cm^3. The lines do not appear in floating zone crystals ($< 10^{17}$ oxygen per cm^3). The pattern is anisotropic with respect to the field orientation and can be fitted with a g tensor with components $g_{[100]} = 2.0029$, $g_{[110]} = 2.0019$, $g_{[1\bar{1}0]} = 2.0096$. Hyperfine structure due to interactions with Si^{29} nuclei is also observed. The hyperfine structure tensor exhibits a [111] symmetry indicating that the electron is not centered on the silicon nucleus with which it is interacting. A model is suggested, consistent with the observed symmetries, according to which vacancies produced during irradiation diffuse to the distorted regions around oxygen atoms. (auth)

20601

SPIN RESONANCE IN ELECTRON IRRADIATED SILICON. G. D. Watkins, J. W. Corbett, and R. M. Walker (General Electric Co., Schenectady, N. Y.). J. Appl. Phys. 30, 1198-1203(1959) Aug.

The spin resonance behavior in room temperature irradiated n-type silicon is observed to be significantly different for silicon grown in quartz crucibles from that grown by the floating zone method. The dominant spectrum in each is discussed. The defects giving rise to the spectra are interpreted as containing impurity atoms and as having formed when the impurities trap mobile interstitials and/or vacancies. In quartz crucible grown silicon, the impurity may be oxygen. In the floating zone material, the impurity appears to be the phosphorus used in the doping. A 20°K irradiation and anneal is described which suggests the temperatures at which this defect motion is occurring. Features of the spin resonance spectra suggest that the vacancy may be the mobile effect. (auth)

20602

NATURE OF BOMBARDMENT DAMAGE AND ENERGY LEVELS IN SEMICONDUCTORS J. H. Crawford, Jr. and J. W. Cleland (Oak Ridge National Lab., Tenn.). J. Appl. Phys. 30, 1204-13(1959) Aug.

The different effects of Co^{60} gamma ray and fast neutron bombardment on the electrical behavior of germanium are discussed in terms of different local distributions of lattice defects expected for these two types of radiation. For the first of these, which is expected to introduce randomly distributed pairs of interstitials and vacancies, the state at 0.20 ev below the conduction band has been found to increase the concentration of ionized scattering centers on becoming occupied with conduction electrons. This state has been ascribed to a mobile interstitial because of its annealing behavior at moderate temperatures. Energy levels in p-type Ge and their annealing behavior are also discussed. In neutron irradiated n-type germanium the behavior of Hall mobility and the apparent energy distribution of defect levels are

discussed in terms of a tentative model for the potential distribution around regions of high local lattice disorder expected to result from neutron bombardment. This model postulates that the disordered region is p type and is surrounded by a positive space charge region in the n-type matrix which insulates it from the matrix. This configuration of electrostatic potential around the disordered region in effect produces an insulating region whose radius is ~10 times that of the disordered region itself. The behavior of Hall mobility in irradiated n-type specimens is consistent with the predictions of this model. (auth)

20603

DISORDERED REGIONS IN SEMICONDUCTORS BOMBARDED BY FAST NEUTRONS. B. R. Gossick (Arizona State Univ., Tempe). J. Appl. Phys. 30, 1214-18 (1959) Aug.

The width and depth of the potential wells surrounding disordered regions in neutron irradiated n-type germanium and extrinsic silicon are estimated. Numerical examples of well dimensions for a wide range of sample characteristics are presented. Some effects of disordered regions, e.g., scattering of conduction electrons, absorption of holes, and polarizability, are discussed. (auth)

20604

RADIATION-INDUCED ENERGY LEVELS IN SILICON. Claude A. Klein (Raytheon Mfg. Co., Waltham, Mass.). J. Appl. Phys. 30, 1222-31(1959) Aug.

Radiation-induced energy levels in silicon have been detected, positioned, and evaluated with the help of many techniques. In this paper, the presently available body of information has been organized, summarized, and analyzed. A short historical review precedes a critical discussion of evidence recently reported for electron-, deuteron-, and neutron-irradiated silicon. Three conclusions emerge from such a confrontation: the energy level pattern is essentially independent of the damaging agent; the pattern seems to present a remarkable symmetry with respect to the middle of the gap; shallow levels close to the band edges are introduced in similar concentrations and at higher rates than the deep traps. On this basis, an attempt is made to interpret the infrared absorption and photoconductivity data of Fan and Ramdas. Problems such as those associated with the charge state of radiation-induced defect centers are examined in the light of a novel experimental approach. (auth)

20605

ELECTRON-BOMBARDMENT DAMAGE IN OXYGEN-FREE SILICON. G. K. Wertheim and D. N. E. Buchanan (Bell Telephone Labs., Inc., Murray Hill, N. J.). J. Appl. Phys. 30, 1232-4(1959) Aug.

Electron-bombardment damage in oxygen-free silicon is compared with that found in pulled crystals which have been previously reported. It is found, in agreement with conclusions drawn from spin resonance experiments, that the level 0.16 ev below the conduction band is associated with oxygen. In oxygen-free silicon a deep level, 0.38 ev below the conduction band is produced in dominant density, and a broad shallow level in lesser concentration. The 0.16-ev level is not produced. The difference between this level scheme and that found in pulled crystals which contain oxygen points up the hitherto unsuspected importance of impurities in the formation of the stable defects, during the rearrangement of the vacancies and interstitials produced by the primary displacement. (auth)

20606

HIGH-ENERGY ELECTRON IRRADIATION OF GERMANIUM AND TELLURIUM. Victor A. J. van Lint and Harold Roth (General Atomics Div., General Dynamics Corp., San Diego, Calif.). J. Appl. Phys. 30, 1235-8 (1959) Aug.

Tellurium samples in which current flowed parallel to the c axis were irradiated at 78°K with 20-Mev electrons. The conductivity increased linearly with a slope of 1.0×10^{-14} $(\text{ohm-cm})^{-1}$ per electron/cm^2 up to at least 3×10^{14} electrons/cm^2. Beyond 3×10^{15} electrons/cm^2 the slope was approximately one tenth of the initial value. The reciprocal of the Hall coefficient decreased at first and then increased. Between 1×10^{13} and 5×10^{13} electrons/cm^2 $1/R_H$ increases linearly from 3×10^{-5} to 6.3×10^{-5} coulomb/cm^3. After irradiation, the samples showed no measurable conductivity changes during 14 hr at 78°K. After a day's anneal at 300°K the 78°K conductivity returned to its preirradiation value. N-type germanium was irradiated with 20-Mev electrons at room temperature. Conductivity measurements indicated that the sample became intrinsic and then p type. However, the detailed dependence of conductivity on radiation dosage did not agree with a calculation based on four energy levels introduced into the gap. Carrier lifetime changes were also observed. (auth)

20607

RADIATION-PRODUCED ENERGY LEVELS IN COMPOUND SEMICONDUCTORS. L. W. Aukerman (Battelle Memorial Inst., Columbus, Ohio). J. Appl. Phys. 30, 1239-43(1959) Aug.

The effects of high-energy radiation on the electrical properties of compound semiconductors are reviewed. Emphasis is placed on those effects which can be interpreted in terms of energy levels. The following compounds are discussed: InSb, InAs, GaSb, AlSb, GaAs, InP, CdTe, and SiC. The implications of bombardment-produced changes in carrier concentration on possible energy levels are considered. Of the compound semiconductors, only InSb, irradiated at 200°K with electrons, has been sufficiently studied to enable a determination of the positions of the energy levels and their rates of generation. The annealing behavior of both InSb and GaSb is complex. A possible interpretation of these annealing characteristics in terms of shifting energy levels is discussed. (auth)

20608

X-RAY AND EXPANSION EFFECTS PRODUCED BY IMPERFECTIONS IN SOLIDS: DEUTERON-IRRADIATED GERMANIUM. R. O. Simmons and R. W. Balluffi (Illinois Univ., Urbana). J. Appl. Phys. 30, 1249-58(1959) Aug.

Important information concerning atomic models of the defects in damaged crystals can be obtained from measurements of bulk length changes, $\Delta L/L$, and x-ray lattice parameter changes, $\Delta a/a$, during irradiation and subsequent recovery. These quantities are not necessarily equal, and their magnitudes and signs may serve to discriminate between possible models. A detailed description of the $\Delta L/L$ and $\Delta a/a$ effects to be expected from models consisting of point imperfections (either uniformly distributed or clustered), displacement spike regions, and dislocation loops is given. Additional discussion is given of the effects expected in measurements of low-angle x-ray scattering, Laue-Bragg reflection broadening, Laue-Bragg reflection intensities, and x-ray diffuse scattering. The currently available experimental results on irradiated germanium are dis-

cussed in an attempt to discriminate between the various models. Comparatively simple models consisting of clusters of vacancies and clusters of interstitials are probably consistent with present experiment. No information is available regarding the shapes of these regions. More complicated models are not excluded, of course. The aforementioned techniques are compared with electrical measurements in semiconductors, and some of the strengths and weaknesses of the various methods are assessed. The need for further measurements of all types is emphasized. (auth)

20609

ANNEALING OF RADIATION DEFECTS IN SEMICONDUCTORS. W. L. Brown, W. M. Augustyniak, and T. R. Waite (Bell Telephone Labs., Inc., Murray Hill, N. J.). J. Appl. Phys. 30, 1258-68(1959) Aug.

Radiation-induced defects studied through changes in conductivity and Hall coefficient have been observed to anneal in a number of different temperature ranges. Only those processes occurring above 80°K and involving defects created by electron irradiation have been considered in this paper. It has been found that the first annealing process in n-type germanium occurs at about 50°C and is structure sensitive, apparently to the original chemical donor impurity. Higher temperature annealing processes, observed at about 200°C and previously interpreted as due to direct annihilation of vacancies and interstitials must also be sensitive to other crystal defects. In p-type germanium there is a process of rearrangement of a defect center at about 200°K, exhibiting first order kinetics, but with a time constant which is strongly dependent upon the charge state of the defect. At about 120°C the defects in p type apparently anneal out completely, in striking contrast to the n-type case. Less extensive silicon measurements, showing lifetime recovery between 200 and 400°C again indicate through their kinetics the importance of other impurities or defects in the annealing process. (auth)

20610

LOW-TEMPERATURE ANNEALING STUDIES IN Ge. J. W. MacKay and E. E. Klontz (Purdue Univ., Lafayette, Ind.). J. Appl. Phys. 30, 1269-74(1959) Aug.

Irradiation at ~10°K using 1.10-Mev electrons produces very different changes in the electrical properties of n-type Ge as compared to those produced in p-type Ge. In n-type Ge, more carriers are removed per incident electron at 10°K than at 78°K. However about 50% of the removed carriers are recovered in two stages of annealing, at 34°K and 64°K, after low temperature irradiation. Irradiation at 0.315 Mev, after a 1.10 Mev irradiation, also produces recovery of about 50% of the carriers removed by the 1.10 Mev irradiation. In p-type Ge, low temperature irradiation is at least 100 times less effective in removing carriers than is the case in n type. Annealing of an irradiated p-type sample to 130°K produces no measurable change. It is concluded that the stability of close-vacancy-interstitial pairs against recombination is less in p type than in n-type Ge. A qualitative argument as to the origin of this difference in stability is presented. (auth)

20611

ULTRASONIC METHODS AND RADIATION EFFECTS IN SOLIDS. Rohn Truell (Brown Univ., Providence). J. Appl. Phys. 30, 1275-8(1959) Aug.

The various mechanisms producing damping of ultrasonic elastic waves in solids are reviewed. Particular attention is given to the changes in attenuation produced by pinning of dislocation lines. Measurements of ultrasonic attenuation in irradiated single crystals of NaCl are presented and discussed, on the assumption that the dislocation density remains constant while the radiation displaced defects pin the dislocations. The effects on the velocity of propagation are discussed on the basis of the same model. (auth)

20612

ELECTRON MICROSCOPE STUDIES ON THE ETCHING OF IRRADIATED GERMANIUM. T. S. Noggle and J. O. Stiegler (Oak Ridge National Lab., Tenn.). J. Appl. Phys. 30, 1279-88(1959) Aug.

Electron microscope and electron diffraction studies on the surfaces of CP-4 etched germanium specimens have shown that the changes in etching behavior induced by fast neutron irradiation occur as a result of a gross change in chemical behavior and cannot be due to local variations in the etching rate in the vicinity of the structural defects introduced by the irradiation. Observations on network structures which are produced under certain conditions of etching indicate that these arise as a result of mechanical preparation of the surfaces or from changes in the etching process and are apparently unrelated to any prior substructure in the material. (auth)

20613

CROSS SECTIONS FOR ATOMIC DISPLACEMENTS IN SOLIDS BY GAMMA RAYS. O. S. Oen and D. K. Holmes (Oak Ridge National Lab., Tenn.). J. Appl. Phys. 30, 1289-95(1959) Aug.

Cross sections for the displacement of lattice atoms by gamma rays for energies up to 5 Mev have been calculated. The principal contribution is found to come from the Compton effect, in which the atoms are displaced by electrons produced by the incident gamma rays. The calculations have been based on the assumption of a sharp threshold energy for displacement, but cross sections have been computed as a function of the assumed threshold energy. Thus, from the present work it is relatively easy to obtain cross sections based upon other displacement functions. (auth)

20614

ENERGY, ORIENTATION, AND TEMPERATURE DEPENDENCE OF DEFECT FORMATION IN ELECTRON IRRADIATION OF n-TYPE GERMANIUM. W. L. Brown and W. M. Augustyniak (Bell Telephone Labs., Inc., Murray Hill, N. J.). J. Appl. Phys. 30, 1300-9(1959) Aug.

From measurements of change in conductivity with electron irradiation of thin n-type germanium samples at 79°K, a threshold energy for the formation of stable acceptor centers has been determined. It is found to be 355 ± 5 kev, corresponding to 15.1 ev for the lightest mass germanium isotope at rest. Taking into account the contribution of lattice vibrations to the displacement energy the threshold is ~16 ev. An orientation dependence has been found in the rate of formation of the centers in agreement with the predictions of Kohn. In order of decreasing rate of center formation the three orientations examined are (111), (110), (100). There is no corresponding orientation dependence in the threshold energy itself. The energy dependence of the rate of acceptor formation suggests the defects are not the closest vacancy-interstitial pairs. A positive temperature dependence of the rate of acceptor formation has been found. This effect is largest at lowest electron energies. It is not explicable by lattice vibrations, although they can contribute to the effect between 79°K and room

temperature. The apparent threshold changes by ~100 kev between 21 and 263°K. (auth)

20615

IRRADIATION DAMAGE IN GERMANIUM AND SILICON DUE TO ELECTRONS AND GAMMA RAYS. Julius H. Cahn (Battelle Memorial Inst., Columbus, Ohio). J. Appl. Phys. 30, 1310-16(1959) Aug.

The simple model for atomic displacements by electrons of Seitz and Koehler is used to calculate the total number of displaced atoms in germanium and silicon due to electrons and gamma rays of energies up to 7 Mev. The calculations are compared to reported experiments in the literature. Electron damage at energies below 1 Mev requires the assumption of threshold energies less than 30 ev, while the higher energy electron damage data are fairly well explained by a 30-ev threshold. The measured gamma-ray cross sections for atomic displacements are an order of magnitude smaller than the calculated cross sections, even for a 30-ev threshold both for silicon and germanium. (auth)

20616

NATURE OF RADIATION DAMAGE IN NICKEL. H. G. F. Wilsdorf (Franklin Inst. Labs., Philadelphia). Phys. Rev. Letters 3, 172-3(1959) Aug. 15.

Since many metals show a considerable increase in yield strength after neutron exposure at pile temperature, the described experiments appeared to be suitable for investigating the nature of radiation damage that can be produced in this temperature range. Nickel specimens of 99.999% purity which were irradiated as foils 1000 to 2000A thick were investigated by transmission electron microscopy. All specimens were sealed in evacuated quartz tubes and irradiated in the Brookhaven Reactor. The same areas were examined at magnifications between 40,000× and 65,000× before and after irradiation with an integrated flux of 10^{18} or 10^{19} nvt. (W.D.M.)

20617

FISSION FRAGMENT DAMAGE IN ZIRCONIA. M. C. Wittels and F. A. Sherrill (Oak Ridge National Lab., Tenn.). Phys. Rev. Letters 3, 176-7(1959) Aug. 15.

Samples of ZrO_2 with known concentrations of fissionable impurities were subjected to thermal neutron dosages at irradiation levels capable of producing partial transformation from the monoclinic to the cubic structure. A reasonable estimate of the number of atoms affected by a fission fragment was made by determining the fraction of transformed material in partially transformed crystals. The method used was to measure the integrated line intensities of the two phases directly from the Debye-Scherrer photographs. (W.D.M.)

20618

X-RAY DOSIMETRY AND CONTACT MICRORADIOGRAPHY WITH COLOR FILM. George L. Clark and Rita M. Uznanski (Univ. of Illinois, Urbana) Science 130, 390(1959) Aug. 14.

The effect of x rays at various voltages and intensities, with monochromatic and polychromatic beams, on Ektachrome daylight and artificial-light film was investigated. The colors were rated according to the Munsell color system and ranged over all the spectrum except red. The color in terms of hue, value, saturation, and chroma was a function of wave-length as well as intensity, and thus the method may be useful in dosimetry as well as in radiography. Microradiographs of metals and wood were remarkable in showing detail not obtainable with conventional black-and-white photographic emulsions. (auth)

20619

RADIATIVE RECOMBINATION IN GERMANIUM CRYSTALS SUBJECTED TO FAST ELECTRON BOMBARDMENT. V. S. Vavilov, A. A. Gippius, M. M. Gorshkov, and B. D. Kopylovskii (Lebedev Inst. of Physics, Academy of Sciences, S.S.S.R.). Zhur. Eksptl'. i Teoret. Fiz. 37, 23-6(1959) July. (In Russian)

Data on the infrared spectrum accompanying the recombination of electrons and holes in germanium single crystals are presented. It is shown that with increase of the concentration of Frenkel defects caused by fast electron bombardment the relative intensity of the emission band with a maximum at 2.35 μ also increases. (auth)

20620

IRRADIATION OF FUEL ELEMENTS CONTAINING UO_2 POWDER. Presented at Nuclear Engineering and Science Conference, April 6-9, 1959, Public Auditorium, Cleveland, Ohio. Preprint V-90. J. L. Bates and W. E. Roake (General Electric Co., Richland, Wash.). New York, Engineers Joint Council, 1959. 15p. $0.50.

These experiments demonstrated that a molten UO_2 core is not disastrous in a fuel element, provided that the design engineer has accepted fission gas release into his design and has incorporated some means of controlling redistribution of the fissile material. This is of considerable importance to the success of fuel elements containing non-sintered uranium oxide, such as the swaged fuel element, and will contribute to the economy of manufacture of difficult elements, such as those enriched with plutonium. The formation of columnar grains of UO_2 without melting, as demonstrated in this work, should permit upward re-evaluation of the thermal capabilities of some fuel element designs utilizing sintered UO_2. The importance of proper UO_2 powder storage conditions was demonstrated. (auth)

20621

THE SWELLING OF IRRADIATED U-Zr ALLOY DURING TEMPERATURE TRANSIENTS. Presented at Nuclear Engineering and Science Conference, April 6-9, 1959, Public Auditorium, Cleveland, Ohio. Preprint V-106. William V. Johnston (Knolls Atomic Power Lab., Schenectady, N. Y.). New York, Engineers Joint Council, 1959. 25p. $0.50.

Small sections of 7 wt. % U-Zr fuel, Zircaloy clad, having from 0.2 to 1.4 at. % burnup were heated rapidly to from 1200 to 1800°F and quenched. Temperature transients were shown to cause swelling of irradiated fuel elements in as few as two seconds. Severity of transients have been shown to increase with increased burnup. Heating to 950°F subsequent to the transient did not cause significant additional swelling. Porosity that was not visible in the samples before the transients was observed after the transients. The possibility that gas bubbles were present in the samples before the transient is considered, but no definite conclusions can be drawn. (C.J.G.)

RADIOACTIVE WASTE

20622 AECU-4271

Fluor Corp., Ltd., Los Angeles.

ECONOMIC STUDY AND REPORT, GROUP II CPP LIQUID WASTE STORAGE FACILITIES. STUDY NO. 8. STORAGE OF NEUTRALIZED WASTE LIQUID.

Sept. 1, 1957. 60p. Includes Study No. 5: TYPES OF UNDERGROUND TANKS AND VAULTS. Aug. 30, 1957. 8p. $18.30(ph), $6.00(mf) OTS.

The estimated cost of providing facilities for cooled storage of 1,200,000 gallons of untreated acid waste from the Idaho Chemical Processing Plant is $2,868,890. The estimated cost of providing facilities for cooled storage of the equivalent amount of neutralized waste (1,960,000 gallons) is $2,732,585. However, this figure includes facilities for the transfer of acid from one existing acid waste tank to another or to the neutralizing facilities. For a direct comparison of costs to store the equivalent amount of untreated acid waste, the transfer facilities cost of $103,815 should be deducted resulting in a comparative over-all cost of $2,628,770. A comparison of costs shows an initial saving of $240,120 if neutralized waste facilities are installed. A summary of annual operating costs for each of the systems on a comparative basis is presented. The foregoing comparisons show that, while there is a saving of approximately $240,000 in the installation of facilities for neutralizing CPP waste liquids, the operating costs, particularly the cost of caustic, makes storage of neutralized wastes economically unattractive. (auth)

20623 DP-394

Du Pont de Nemours (E. I.) & Co., Savannah River Lab., Aiken, S. C.

ADSORPTION OF FISSION PRODUCTS BY SAVANNAH RIVER PLANT SOIL. William E. Prout. July 1959. 17p. Contract AT(07-2)-1. $0.50(OTS).

Data are presented for the equilibrium distribution of cesium, strontium, plutonium, ruthenium, and zirconium–niobium between soil of the Savannah River Plant and various aqueous solutions. Low cation concentration and a pH range of 7 to 9 were most favorable for absorption of these elements on the soil. (auth)

20624 HW-56001 F

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

INTERIM REPORT NO. 7 ON INTERNAL CHEMICAL DECONTAMINATION OF KW, KE, AND B REACTORS REAR FACE PIPING WITH TURCO 4306-B. Harry F. Jensen. July 25, 1959. 11p. $1.80(ph), $1.80(mf) OTS.

Decontamination of the three reactors was made with a minimum of additional equipment or modification of the reactor piping using Turco 4306-B. Reduction of the KW and KE rear face radiation levels by 75 and 85%, respectively, was achieved by this process. At the K Reactors, rear face radiation levels were reduced from 150 to 450 mrads to 25 mrads. To date there has been no evidence other than that Turco 4306-B is an exceedingly safe and effective agent when used as indicated. (W.L.H.)

20625 HW-61323

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

A CLOSED CIRCUIT TELEVISION SYSTEM FOR IN-WELL USE—INTERIM REPORT. C. A. Ratcliffe. Aug. 5, 1959. 11p. Contract AT(45-1)-1350. $3.30 (ph), $2.40(mf) OTS.

Nearly six hundred wells have been used and will continue to be used for observation and monitoring purposes of direct interest to ground disposal of radioactive wastes. Many wells were drilled over ten years ago, and their use as proper sampling points may be seriously questioned due to closing of perforations from rust and scale over the years. A closed circuit television system appeared to be the optimum means to view casing walls to determine the conditions of perforations. A submergible television camera, cable, and monitor were acquired and tested. Satisfactory performance was obtained, and it appears that much useful information may be obtained. (W.L.H.)

20626 ORNL-2769

Oak Ridge National Lab., Tenn.

SURVEY ON THE MEASUREMENT OF THERMAL CONDUCTIVITY OF SOLIDS PRODUCED BY EVAPORATION AND CALCINATION OF SYNTHETIC FUEL REPROCESSING SOLUTIONS. H. W. Godbee and J. T. Roberts. Aug. 25, 1959. 25p. Contract W-7405-eng-26. $0.75(OTS).

Simplified equations to calculate the maximum temperature rise in stored solid wastes are given. The need for thermal conductivity values of solid wastes is demonstrated using these equations. For 55-gal containers of a calcined TBP-25 waste in a granite cave the temperature would rise 694 to 3307°F depending on the decay prior to storage. A program is proposed for measuring the thermal conductivity of solids produced by evaporation and calcination of synthetic fuel reprocessing solutions. Thermal conductivity is defined and factors influencing the thermal conductivity of nonmetallic solids are considered. Particularly the effects of temperature and porosity on thermal conductivity are considered. Methods of measuring thermal conductivity are outlined. Criteria used in selecting an arrangement of apparatus for measuring thermal conductivity are enumerated. An apparatus for determining the thermal conductivity of solids produced by evaporation and calcination of synthetic fuel reprocessing solutions is described. (auth)

20627

PROBLEMS OF RADIOACTIVE WASTE PRODUCTS IN MODERN INDUSTRY. Spitsyn. (Translated from Referat. Zhur. Khim. No. 12, 1958, Abstract No. 40117.)

The methods are briefly described for the separation and the utilization of the degradation products of U^{235}, primarily of Cs^{137} and Sr^{90} (evaporation, precipitation, concentration, and others), as well as the methods of burying the radioactive waste products.

20628

DEVELOPMENT OF DESIGN PRINCIPLE FOR DISPOSAL OF REACTOR FUEL WASTE INTO UNDERGROUND SALT CAVITIES. Presented at Nuclear Engineering and Science Conference, April 6-9, 1959, Public Auditorium, Cleveland, Ohio. Preprint V–2. Shosei Serata and Earnest Gloyna (Univ. of Texas, Austin). New York, Engineers Joint Council, 1959. 28p. $0.50.

Theoretical equilibrium relationships as substantiated by experimental studies are presented for use in the design of salt cavities, reduction of cavity volume, development of the plastic zone, and stress redistribution around the cavity as functions of cavity depth, strength of salt and physico-chemical effects of the waste. (auth)

20629

THERMAL CONSIDERATIONS IN THE STORAGE OF RADIOACTIVE WASTES IN SALT FORMATIONS. Presented at Nuclear Engineering and Science Conference, April 6-9, 1959, Public Auditorium, Cleveland, Ohio. Preprint V–4. Robert S. Schechter and Earnest F. Gloyna (Univ. of Texas, Austin). New York, Engineers Joint Council, 1959. 26p. $0.50.

The thermal aspects of storing liquid radioactive wastes in deep underground storage sites are examined theoretically. The results indicate that the numerical answers are extremely sensitive to the values of the physical parameters and that the temperature increase is diminished if the waste is diluted, rather than partially filling the underground cavity. (auth)

20630

DISPOSAL OF RADIOACTIVE LIQUIDS FROM NUCLEAR POWERED SHIPS. Presented at Nuclear Engineering and Science Conference, April 6-9, 1959, Public Auditorium, Cleveland, Ohio. Preprint V-5. J. M. Smith (General Electric Co., San Jose, Calif.). New York, Engineers Joint Council, 1959. 9p. $0.50.

Disposal of radioactive wastes expected from nuclear powered ships is reviewed in the light of recent studies. Safe and economical release of such wastes directly to sea, with reasonable limitations near land, is indicated as being feasible. (auth)

20631

THE NEED FOR BIOLOGICAL MONITORING OF RADIOACTIVE WASTE STREAMS. Presented at Nuclear Engineering and Science Conference, April 6-9, 1959, Public Auditorium, Cleveland, Ohio. Preprint V-6. Richard F. Foster (General Electric Co., Richland, Wash.). New York, Engineers Joint Council, 1959. 19p. $0.50.

Data are presented to illustrate how radiation exposure arising from radioactive wastes in surface waters may be either over- or under-estimated when computed from discharge rates. The importance of biological concentration of certain isotopes and the need for monitoring at various points of water use are emphasized. (auth)

20632

RADIOACTIVITY IN WATER-ENVIRONMENTAL SURVEILLANCE. Presented at Nuclear Engineering and Science Conference, April 6-9, 1959, Public Auditorium, Cleveland, Ohio. Preprint V-22. Harry P. Kramer, Dade W. Moeller, and Donald A. Pecsok (Robert A. Taft Sanitary Engineering Center, Cincinnati). New York, Engineers Joint Council, 1959. 12p. $0.50.

The growing applications of nuclear technology generate wastes which challenge our environment. Knowledge of the levels of radioactive materials is necessary. Environmental surveillance programs should be instituted to provide this knowledge. Water monitoring constitutes one very important phase of such a program. Instrumentation and methodology required for such a program have been developed. (auth)

20633

DEVELOPMENT STUDIES ON THE SOLIDIFICATION OF RADIOACTIVE WASTE BY FLUID BED CALCINATION. Presented at Nuclear Engineering and Science Conference, April 6-9, 1959, Public Auditorium, Cleveland, Ohio. Preprint V-48. J. W. Loeding, E. L. Carls, and A. A. Jonke (Argonne National Lab., Lemont, Ill.). New York, Engineers Joint Council, 1959. 14p. $0.50.

Recent experimental results on the calcining of radioactive waste by the use of a fluidized bed technique are presented together with conclusions and a brief description of the process and equipment. Particular emphasis is placed on clean-up of volatile ruthenium and nonvolatile particulate from the calciner off-gas. (auth)

REACTORS

General

20634 APEX-504

General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati.

COMPARISON OF BULK SHIELDING REACTOR CENTERLINE MEASUREMENTS IN WATER WITH PREDICTIONS. A. W. Casper. Nov. 1958. 26p. Contracts AF33(600)-38062 and AT(11-1)-171. $1.00(OTS).

Measurements of fast neutron and gamma ray dose rates in water along the centerline of the Bulk Shielding Reactor (BSR) are compared with predictions made by use of three available computer programs. It is found that the predictions are very dependent on the assumptions made concerning power distribution and that the more accurate descriptions of the source lead to predictions that agree with measurements to within 20% throughout thickness ranges as great as 100 centimeters of water. (auth)

20635 BNL-4355

Brookhaven National Lab., Upton, N. Y.

LMFR BIMONTHLY PROGRESS REPORT FOR NOVEMBER-DECEMBER 1958. Feb. 5, 1959. 86p. $13.80(ph), $4.80(mf) OTS.

Work on the stability of general LMF reactors was continued. An evaluation of resonance parameters for Bi was completed. The measured B^2 for the "18" stack was $(10.1 \pm 0.5) \times 10^{-4}$ cm^{-2}; B^2 calculated by age-diffusion theory was 9.4×10^{-4} cm^{-2}. The "19" stack was formed and a preliminary $B^2 = 7.5 \times 10^{-4}$ cm^{-2} was determined. Zirconium dissolution rates in Bi-Mg were reduced by a factor of 10 when the mixture was not agitated. Ta and Mo appear to have satisfactory corrosion resistance to NaCl-KCl-$MgCl_2$ mixtures containing 5% $BiCl_3$. Results also indicate the suitability of several chromium steels. After standing four hours, three fourths of the fission products had risen to the top half of a 4-in. deep volume of liquid Bi to which 0.5% Zn had been added. Data were obtained to give the rates at which both fission product I and Xe penetrate graphite from liquid metal fuels. The corrected value for the solubility of Xe in Bi is 2.7×10^{-9} M/(cm^3)(atm) at 540°C. ThO_2-Bi slurries of good stability were obtained which show no evidence of significant ThO_2 reduction. Rates of heat transfer to Hg flowing parallel to tubes through a staggered tube bundle were measured, calculated, and compared. Chromium-molybdenum steel was excessively corroded in inhibited UBi systems in a very short period. Static tracer experiments suggest that Bi-Zr alloys form a more uniform deposit on steel surfaces than the same alloys with Mg additions. (For preceding period see BNL-4097.) (D.E.B.)

20636 ESSO-MA-4

Esso Research and Engineering Co. Products Research Div., Linden, N. J.

LUBRICATION REQUIREMENTS OF NUCLEAR-POWERED SURFACE VESSELS. E. H. Okrent. Aug. 1, 1959. 66p. Contract MA-1814. $1.75(OTS).

This study has involved a literature review in the areas of reactor design, radiation stability of lubricants, and the lubrication of major components of nuclear-powered surface vessels. The lubrication of components associated with the nuclear heat source, such as pumps, valves, control rod drives, auxiliary

systems, and fuel handling equipment present no major lubrication problems. The lubrication of components associated with the propulsion gear and auxiliary condensing and fuel systems presents no radiation stability problems, since the dose rates in these components are insignificant. Existing static irradiation stability data are adequate to predict lubricant performance provided dose rates are held below 10^4 r/hr. (W.L.H.)

20637 HW-45000(Rev.)
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
1706-KER COOLANT TEST FACILITY OPERATIONS MANUAL. R. V. Dulin. Jan. 23, 1958. 102p. Contract W-31-109-Eng-52. $16.80(ph), $5.70(mf) OTS.

This procedure is intended to be used as an instruction and guide for the operation of KER loops and as an aid in familiarization and understanding of the general operation of the loops. (W.L.H.)

20638 HW-59207
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
RADIONUCLIDES IN HIGH TEMPERATURE IN-REACTOR LOOPS. Lyle D. Perrigo, Jr. Feb. 10, 1959. 21p. Contract W-31-109-Eng-52. $3.30(ph), $2.40(mf) OTS.

The identity, amount, and source of radioisotopes found in Hanford loops were investigated. The amounts of P^{32} and tritium found experimentally agree reasonably well with the theoretical values. The major short-lived contributors in all systems studied were Mn^{56}, Na^{24}, Si^{31}, and F^{18}, while the long-lived radioisotopes found were Cr^{51}, Co^{60}, and Fe^{59}. The neutral loop has lower activity levels than does the low-pH loop for Mn^{56}, Si^{31}, Co^{60}, and Na^{24}. The high Si^{31} activity in the low-pH loop and the Mn^{54} and Co^{58} activities in the low-pH and neutral systems indicate the occurrence of the (n-p) reactions. Data are tabulated and presented graphically. (J.R.D.)

20639 MND-E-1718-2
Martin Co. Nuclear Div., Baltimore.
NUCLEAR ANALYTICAL METHODS AND CORE CHARACTERISTICS — ERDL TASK 100, PHASE 3. T. M. Olsen. June 1959. 210p. Contract DA-44-009-ENG-3318.

The reactor analysis methods and techniques used in ERDL Task 100, Phase 3, Zero Power Check Point Experiments, and Task 103, Phase 1, Core Extrapolation Experiments, are described. These methods and techniques are used primarily for determining the reactivity of highly enriched water-moderated reactors with various control rod positions, core–water relations, and fuel–poison conditions. The methods can also be used to determine rod bank worth, fine flux distributions through fuel cells, consistent reflector savings, and buckling. Material volume fraction data are also included as well as the theory and equations used for the excursion analysis performed as part of the hazards evaluation for the Core Extrapolation Experiments. A description of the digital machine programs developed to apply the various methods and techniques is included. (J.R.D.)

20640 NAA-SR-1510
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
DANGER COEFFICIENT MEASUREMENTS USING A WATER BOILER REACTOR. Bernard A. Engholm. Mar. 1, 1956. Decl. July 1, 1959. 59p. Contract AT-11-1-GEN-8. $1.50(OTS).

The use of a water boiler reactor as a danger coefficient test instrument has been investigated, with emphasis on the testing of reactor materials for neutron absorbing impurities and the testing of uranium for enrichment variations. After calibration of the WBNS coarse control rod, tests were made on a variety of materials including beryllium, boron trifluoride, iron and steel, natural uranium metal and oxide, and uranium metal of various enrichments. Several experiments were conducted to evaluate the sources and magnitudes of errors in danger coefficient testing. On the basis of the data obtained from sample testing and auxiliary experiments, the sensitivity of the WBNS for absorption and enrichment testing was determined, as well as other constants relating to danger coefficient measurements. The Water Boiler Neutron Source has been found to be well suited to danger coefficient testing. Small absorption differences between samples of similar geometry and nuclear properties can be determined to a standard deviation of 0.002 cm^2. The danger coefficient technique using the WBNS compares favorably with other methods of absorption detecting methods, such as the shotgun test or chemical analysis. Enrichment differences between natural uranium samples of only 500 grams can be detected to ±0.0008 per cent U^{235} by weight, and between 3 per cent enriched samples to ±0.0028 per cent U^{235}. In enrichment testing relative values can be found to an accuracy equivalent to those obtained from spectrographic analyses. With improvements in the WBNS core arrangement so that larger samples could be handled, and relocation of the glory hole to the flux center of the core, greater sensitivity could be obtained. The WBNS compares favorably to other reactors used for danger coefficient work. (auth)

20641 ORNL-1868
Oak Ridge National Lab., Tenn.
DISASSEMBLY AND POSTOPERATIVE EXAMINATION OF THE AIRCRAFT REACTOR EXPERIMENT. W. B. Cottrell, T. E. Crabtree, A. L. Davis, and W. G. Piper. Apr. 15, 1958. Decl. July 16, 1959. 50p. Contract W-7405-eng-26. $7.80(ph) $3.30(mf) OTS.

A detailed account of ARE disassembly operations and the radiation levels encountered is given. Samples taken from various parts of the reactor are listed, and completed examinations are reported. Samples examined include those taken from the moderator, fuel and coolant lines, pumps, valves, structural material, and coolant. (J.R.D.)

20642 RFX-11
Aktiebolaget Atomenergi, Stockholm.
KOKNINGSSIMULERANDE EXPERIMENT I AB ATOMENERGIS FÖRSÖKREAKTOR R1. (Simulated Boiling Experiment in AB Atomenergi's Research Reactor R1.) O. Nylund. July 1, 1958. 32p.

In the calculation of boiling reactors and the dimensions of the control and safety systems for ordinary D_2O reactors, it is of value to know the reactivity changes induced by boiling in the reactor. Simulated boiling experiments were made in the Swedish R1 reactor with 7 uranium fuel rods and with 19 uranium oxide fuel rods. In the experiments with metal fuels, boiling was simulated by air bubbles, and in experiments with oxide fuels the moderator was completely replaced with air. The changes in the reactor parameters are calculated for both cases. (J.S.R.)

20643 WAPD-A1W-P(CE-2)-15

Westinghouse Electric Corp. [Atomic Power Div.], Pittsburgh.

ROD INSERTION AND SOURCE INSERTION METHODS FOR MEASURING REACTOR POWER. W. B. Doub. Oct. 1958. 12p. $3.30(ph), $2.40(mf) OTS.

In the rod insertion and source insertion methods of power measurement, the power is inferred essentially by comparing the total fission source of the reactor to a known external source. Theory is given which includes a correction factor accounting for the differing shapes and spectra of the two sources. (W.D.M.)

20644 CEA-tr-A-579

SUR LE COMPORTEMENT DANS LE TEMPS DU RÉACTEUR À EAU BOUILLANTE. (The Period Behavior of a Boiling Water Reactor.) A. Kirchenmayer. Translated into French from Atomkernenergie 3, 6-10 (1958). 19p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 6848.

20645 NASA-TT-F-1

THE CHARACTERISTICS OF HYDROGEN AND WATER AS WORKING GASES FOR REACTOR-HEATED ROCKET MOTORS. (Die Eigenschaften von Wasserstoff und Wasser als Arbeitsgase für Kernenergetisch Beheizte Raketentriebwerke). Irene Sänger-Bredt. Translated from Astronaut. Acta 3, 241-80(1957). 52p.

Hydrogen and water vapor have been investigated as to their applicability as working fluids with an energy higher by several orders of magnitude than has hitherto been available with steam boilers. Enthalpy-entropy diagrams are computed for either gas, with complete regard to dissociation, as well as ionization, over the pressure range between 10^{+1} to 10^{-3} atm, and within the temperature range between 500 and 10,000°K. Exhaust velocities possible for water, or water vapor, are derived and compared. Heat transfer to the combustion chamber walls is examined. Three methods of heating the working fluid are investigated: fission reactor, arcs, and fusion reactors. (auth)

20646

A CIRCULATION LOOP AS A RADIATION SOURCE, IN PARTICULAR TO RADIATION CHEMISTRY. Yu. S. Ryabukhin and A. Kh. Breger. Atomnaya Energ. 7, 129-37(1959) Aug. (In Russian)

The previously discussed loop with one isotope is expanded to a generalized case with several radioisotopes producing progenies. An absolute maximum capacity and neutron flow per unit of power for a series of elements which are used as activated material is analyzed. Indium and its alloys are considered as the most suitable material. A loop containing fissionable isotopes (uranium loop) is also studied. It is shown that cycling partially burned out fuel elements from a reactor into an irradiation facility and back again increases the capacity of a facility two to four fold in comparison to the capacity of facilities using completly burned out fuel. (tr-auth)

20647

TECHNOLOGICAL PROBLEMS IN THE PRODUCTION OF CERAMIC FUELS FOR WATER REACTORS. G. Frigerio (Fiat, Sezione Energia Nucleare, Turin). Energia nucleare (Milan) 6, 502-10(1959) Aug. (In Italian)

The criteria for the acceptance of uranium dioxide ceramic fuels for power reactors are briefly reviewed. Specific problems in the fabrication of UO_2 pellets are examined. Possibilities for the simplification of the fabrication procedures, and consequently for the reduction in cost, for ceramic fuels are indicated. (tr-auth)

20648

SHIELDING OF NUCLEAR RADIATION. I. Benfenati (Sorin, Milan). Energia nucleare (Milan) 6, 511-20 (1959) Aug. (In Italian)

The present state of knowledge in shielding analysis is reviewed, and the difficulties encountered in developing practical methods of shield design evaluation are indicated. Special attention is given to the Spencer-Fano moments method and to the removal cross section theory, which represent the basis of shielding analysis. (auth)

20649

REACTORS FOR UNIVERSITY RESEARCH. Nuclear Science Series, Report No. 28. Includes Papers: RESEARCH REACTORS—TYPES AND FLUX LEVELS. T. J. Thompson (Massachusetts Inst. of Tech., Cambridge); SAFETY AND SITE ELECTION. Robert G. Cochran (Pennsylvania State Univ., University Park); PURPOSES AND PROCEDURES IN THE LICENSING OF REACTOR FACILITIES. Clifford K. Beck and Edson G. Case (Atomic Energy Commission, Washington, D. C.); REACTOR COSTS. H. J. Gomberg (Univ. of Michigan, Ann Arbor). J. Eng. Educ. 49, No. 5(1959) Feb. Washington, D. C., National Academy of Sciences—National Research Council, [1959]. 34p.

20650

VIBRATION OF RODS IN PARALLEL FLOW. David Burgreen (Nuclear Development Corp. of America, White Plains, N. Y.). Nucleonics 17, No. 8, 78-9(1959) Aug.

The test results of an experimental program to determine the nature and magnitude of vibration of clustered rods in parallel flow are plotted in terms of the non-dimensional parameter $K_1\Gamma^{1/4}\Omega$. (C.J.G.)

20651

APDA INTRODUCES STATISTICAL HOT-SPOT FACTORS. Nucleonics 17, No. 8, 92-6(1959) Aug.

A new method for calculating hot spot factors according to statistical principles is given. This method enables one to quote a definite number for the probability that the actual hot-spot temperature will not exceed the calculated value. A hot spot factor of less than 1.2 can be justified by the statistical method compared to a 1.5 factor by the traditional method. The difference means an automatic 25% increase in the design output power. Typical hot-spot-factor calculations are summarized. (C.J.G.)

20652

APPROXIMATION OF THE TRANSIENT BEHAVIOR OF REACTORS BY LESS THAN SIX GROUPS OF DELAYED NEUTRONS. A. Kirchenmayer (Technische Hochschule, Stuttgart). Nukleonik 1, 245-7(1959) Aug. (In German)

From an approximation of the decay curve of delayed neutrons, an approximation representation was obtained. With two groups of delayed neutrons this approximation is satisfactory for the transfer function in the range up to approximately 10 sec and for frequency response above 0.1 Hz. For wider approximation ranges more groups are introduced in a similar manner. (tr-auth)

20653

THE GENERAL EXPRESSION FOR THE AVERAGE

LIFETIME OF NEUTRONS IN MULTIGROUP DIFFUSION THEORY AND FOR A REACTOR OF M DIFFERENT MEDIA. Ahmet Yüksel Özemre (Inst. for Theoretical Physics, Istanbul). Nukleonik 1, 248-50 (1959) Aug.

The expression for the average lifetime of neutrons in a critical nuclear reactor composed of M different media is deduced from multigroup considerations of the elementary diffusion theory. (auth)

20654

ADJUSTMENT OF THE NEUTRON SPECTRA IN THE ARGONAUT REACTOR. H. Märkl (Siemens-Schuckertwerke AG., Erlangen, Ger.). Nukleonik 1, 251-9(1959) Aug. (In German)

The question of the adjustment of the neutron spectra in the SNDR (Siemens' natural uranium, heavy water reactor) insert of the Argonaut Reactor was theoretically investigated using the two-group theory. It is shown that by the introduction of a 3.1-cm thick H_2O layer or a 7.35-cm thick D_2O layer between the Argonaut core and the SNDR insert, the overlap of the hard Argonaut spectra can be eliminated in the insert so that the characteristic spectrum of the SNDR lies in the lattice to be investigated. Further investigations were instituted to determine which modification of the arrangement was necessary to obtain, not only the same neutron spectrum, but also the same flux curvature in the SNDR insert as is produced in the SNDR. The method of calculating the corresponding arrangements was also considered. (tr-auth)

20655

THE THEORY OF A MEASUREMENT METHOD FOR THE RESONANCE TRANSMISSION PROBABILITY. W. Oldekop (Siemens-Schuckertwerke AG., Erlangen, Ger.). Nukleonik 1, 259-65(1959) Aug. (In German)

A method for the measurement of $\underline{p}$ was discussed in which a relatively small section of the lattice to be investigated was imbedded in an external reactor, and the cadmium ratio of the neutrons captured in U^{238} was measured. The relationship between $(1-\underline{p})/\underline{p}$ and the measurable U^{238} capture ratio was derived with consideration of the flux perturbation restricted by the external reactor. As an example, a natural uranium D_2O insert in the Argonaut reactor was examined. The calculations show that a determination of $\underline{p}$ with an accuracy of $\pm 0.5\%$ should be possible when the U^{238} capture ratio is measured with an accuracy of $\pm 3\%$ and when variation in the spectral flux ratio can be established at two homologous points of the insert with an accuracy of $\pm 3\%$. (tr-auth)

20656

THEORY OF THE REACTIVITY CONTRIBUTION OF CAVITIES AND A METHOD FOR THE DETERMINATION OF k_∞. W. Humbach and W. Oldekop (Siemens-Schuckertwerke AG., Erlangen, Ger.). Nukleonik 1, 265-72(1959) Aug. (In German)

The reactivity ρ originating in a critical system in the production of a cavity was calculated theoretically by perturbation methods. The perturbation theoretical treatment of cavities by the multigroup calculation was possible from a consistent execution of the P_1 approximation. Some peculiarities of the P_1 approximation in the multigroup calculation, such as the appearance of extradiagonal diffusion coefficients, were discussed. In the removal of a reactor part, the reactivity of the total system varies (a) when the multiplication factor k_∞ of the part removed is ± 1, (b) when the flux ϕ or its adjoint ϕ_i^+ in the removable part varies spatially or spectrally from the flux $\phi_{i,\infty}$ or $\phi_{i,\infty}^+$ in the corresponding infinite expanded medium, (c) when the flux $\phi_{i,\infty}$ or $\phi_{i,\infty}^+$ are position dependent as in the case in heterogeneous reactors, and (d) when the boundary surfaces of the cavity do not agree with the cell boundaries. The relationship between ρ and k_∞ make possible an experimental determination of the multiplication factor k_∞. The perturbation effects caused by (b), (c), and (d) were estimated numerically for the example of a UO_2/D_2O insert in the Argonaut Reactor. (tr-auth)

20657

CHEMICAL PRODUCTS WHICH ARE FORMED IN A NUCLEAR REACTOR. Dizdar. Technika (Belgrade) 12, No. 3, (1957). (Translated from Referat. Zhur. Khim. No. 12, 1958, Abstract No. 40166.)

Chemical products which are formed in nuclear reactors (Pu, degradation products, radioisotopes) are discussed. Importance of Pu and its chemical, physical, and nuclear properties are also examined.

20658

THE UNIVERSITY OF FLORIDA TRAINING REACTOR. Presented at Nuclear Engineering and Science Conference, April 6-9, 1959, Public Auditorium, Cleveland, Ohio. Preprint V-10. James M. Duncan (Univ. of Florida, Gainesville). New York, Engineers Joint Council, 1959. 27p. $0.50.

The University of Florida Training Reactor is a 10 kw, water-cooled and moderated, graphite-reflected reactor with flat, aluminum-clad, fuel plates of uranium-aluminum alloy. It is housed in a building approximately 60 feet by 80 feet. (auth)

20659

INSTRUMENTATION FOR EXPERIMENTAL REACTOR KINETIC STUDIES. Presented at Nuclear Engineering and Science Conference, April 6-9, 1959, Public Auditorium, Cleveland, Ohio. Preprint V-13. E. L. Gardner (Atomics International, Canoga Park, Calif.). New York, Engineers Joint Council, 1959. 16p. $0.50.

Reactor power excursions involving stable periods ranging from a few seconds to two milliseconds have been experimentally investigated in the course of the Kinetic Experiments on Water Boilers program. Reactivity introduction, power and temperature measurement, and data analysis have imposed some unique requirements on instrumentation and special apparatus. (auth)

20660

SIMULATION OF EBWR FOR THE GENEVA CONFERENCE. Presented at Nuclear Engineering and Science Conference, April 6-9, 1959, Public Auditorium, Cleveland, Ohio. Preprint V-15. J. W. Schwartzenberg, J. M. Finan, V. S. Underkoffler, and R. N. Brey, Jr. (Leeds & Northrup Co., Philadelphia). New York, Engineers Joint Council, 1959. 31p. $0.50.

The EBWR (Experimental Boiling Water Reactor) was designed to serve the threefold purpose of a mature exhibit for the 1958 Geneva Conference, an operator training device, and an experimental tool for control system studies. Complete operation of the simulator covers eight decades. All major operating interlocks are included to shutdown simulated reactor. (auth)

20661

APPROXIMATE SOLUTIONS TO THE REACTOR KINETIC EQUATIONS FOR RAMP INPUTS. Presented at Nuclear Engineering and Science Conference, April 6-9,

1959, Public Auditorium, Cleveland, Ohio. Preprint V–17. John MacPhee (AMF Atomics, Greenwich, Conn.). New York, Engineers Joint Council, 1959. 28p. $0.50.

Approximate methods, which are simple and quick to use, are presented for finding the response of a critical and a subcritical reactor to ramp inputs of δk. Exact solutions obtained with a digital computer are used to demonstrate that the methods are conservative, yet more accurate than Newsom's. (auth)

20662

A DIGITAL STARTUP CONTROL FOR MOBILE NUCLEAR REACTORS. Presented at Nuclear Engineering and Science Conference, April 6-9, 1959, Public Auditorium, Cleveland, Ohio. Preprint V–45. Samuel N. Lehr (General Electric Co., Cincinnati) and Vernon P. Mathis (General Electric Co., Syracuse, N. Y.). New York Engineers Joint Council, 1959. 27p. $0.50

A study was made of a digital startup control for a mobile nuclear reactor. System parameters, as well as pulse circuitry and period computation techniques, are discussed. Recommendations are made for a digital display and conclusions are drawn. (auth)

20663

MAGNETIC AUTOMATIC POWER-RANGE CONTROL FOR AN AIRCRAFT NUCLEAR REACTOR. Presented at Nuclear Engineering and Science Conference, April 6-9, 1959, Public Auditorium, Cleveland, Ohio. Preprint V–46. Jack A. Russell, Stuart F. Hemmenway, John L. Scharf, and Phillip C. Sharr. New York, Engineers Joint Council, 1959. 31p. $0.50.

Control system philosophy for an aircraft nuclear power plant is discussed briefly. Advantages are presented for a power-range magnetic control system with a minimum number of moving parts. Control system elements and computing devices are discussed in detail. Performance of a bread-board version of the control system is evaluated. (auth)

20664

ELECTRICAL CONTROL SYSTEM COMPONENTS FOR STARTING AIRCRAFT PROPULSION REACTORS. Presented at Nuclear Engineering and Science Conference, April 6-9, 1959, Public Auditorium, Cleveland, Ohio. Preprint V–47. P. K. Hiser, M. E. Ward, A. D. Silcox, and R. H. Willsey (General Electric Co., Cincinnati). New York, Engineers Joint Council, 1959. 30p. $0.50.

Components for an aircraft reactor startup control system are described. Major design considerations for the electrical circuitry and the mechanical configuration are outlined and briefly discussed. The system described includes both vacuum tube and magnetic amplifier circuits. (auth)

20665

STATUS OF RESEARCH AND TEST REACTORS. Presented at Nuclear Engineering and Science Conference, April 6-9, 1959, Public Auditorium, Cleveland, Ohio. Preprint V–80. Leonard E. Link (Argonne National Lab., Lemont, Ill.). New York, Engineers Joint Council, 1959. 25p. $0.50.

Summary of the general and special test and research reactors built and under construction is given. The types of experiments influencing advanced designs and features being incorporated in advanced designs are discussed. (auth)

20666

AEC REACTOR PHYSICS PROGRAM. Presented at Nuclear Engineering and Science Conference, April 6-9, 1959, Public Auditorium, Cleveland, Ohio. Preprint V–82. William C. Bartels (U. S. Atomic Energy Commission, Washington, D. C.). New York, Engineers Joint Council, 1959. 11p. $0.50.

The Atomic Energy Commission is supporting a broadly defined effort to develop reactor physics information. Studies under way include static reactor physics, reactor kinetics, neutron slowing down, cross section measurements, improvement of analysis techniques, measurements of radiation penetration through shield materials, and a program to compile, digest, and publish information relevant to reactor physics. (auth)

20667

FABRICATION OF BR-2 FUEL ELEMENTS. Presented at Nuclear Engineering and Science Conference, April 6-9, 1959, Public Auditorium, Cleveland, Ohio. Preprint V–85. Alfred Strasser (Nuclear Development Corp. of America, White Plains, N. Y.). New York, Engineers Joint Council, 1959. 15p. $0.50.

Fabrication techniques for the BR-2 (Belgian Test Reactor) fuel elements are described. The fuel element consists of six concentric tubes of Al–U alloy clad with Al. (auth)

20668

THE FABRICATION OF TUBULAR URANIUM FUEL ELEMENTS. Presented at Nuclear Engineering and Science Conference, April 6-9, 1959, Public Auditorium, Cleveland, Ohio. Preprint V–101. C. E. Polson, H. Davis, J. F. MacNeill, J. F. Schlitz, J. W. Magoun, and E. S. Noe (National Lead Co. of Ohio, Cincinnati). New York, Engineers Joint Council, 1959. 25p. $0.50.

A number of processes are described which have been investigated for making uranium tubes. Included are: horizontal centrifugal casting of tubular feed stock for forming operations; casting of hollow feed stock; extrusion of tubes from cast hollow feed stock; assel mill elongation, "Rockrite" forming, and "Hamiroll" swaging of cast hollows; and machining processes for making tubular elements to close tolerances. The work was performed to demonstrate that conventional industrial equipment can be utilized for the making of uranium tubes. (C.J.G.)

20669

OPERATIONAL PROBLEMS OF THE ORIGINAL HANFORD PRODUCTION REACTORS. Presented at Nuclear Engineering and Science Conference, April 6-9, 1959, Public Auditorium, Cleveland, Ohio. Preprint V–117. John R. Young (General Electric Co., Richland, Wash.). New York, Engineers Joint Council, 1959. 18p. $0.50.

The three original Hanford production reactors and water plants are described, including a water plant flow diagram and illustrations of the reactor and a process tube channel. The fuel element failure, graphite distortion, tube replacement, water leak, gas leak, and radiation exposure problems are discussed briefly. (auth)

20670

AN AUTOMATIC DEVICE FOR POWER MAPPING IN HETEROGENEOUS REACTOR CORES. Presented at Nuclear Engineering and Science Conference, April 6-9, 1959, Public Auditorium, Cleveland, Ohio. Preprint V–124. J. Harry Mortenson and Russell M. Ball (Babcock & Wilcox Co., Lynchburg, Va.). New York, Engineers Joint Council, 1959. 20p. $0.50.

An instrument has been developed for measuring power distributions in the reactor core of the NMSR Critical Experiment; however, the method is adaptable for power mapping in almost any type of heterogeneous reactor core. The measurement is accomplished by feeding irradiated fuel pins into an automatic scanning device which measures the gamma activity of the fission products at increments along the length of the pins. The decay in the intensity of the gamma activity is automatically compensated for during a counting session, and the net activity of each increment of the fuel pins is automatically recorded by a digital printer. (auth)

20671

AN ELECTRIC DISSOLVED HYDROGEN ANALYZER. Presented at Nuclear Engineering and Science Conference, April 6-9, 1959, Public Auditorium, Cleveland, Ohio. Preprint V-127. E. R. Hill and D. C. Griffith (Swartwout Co., Cleveland). New York, Engineers Joint Council, 1959. 11p. $0.50.

An instrument consisting of a detector installed in the process piping and a remote mounted receiver has been developed which will give a continuous direct indication of hydrogen concentration as measured at the detector. This device is powered from the normal 60-cycle power line and operates, without correction, over the pressure and temperature range of the primary loop. (auth)

20672

OPERATING EXPERIENCE WITH THE CRITICAL EXPERIMENT REACTOR. Presented at Nuclear Engineering and Science Conference, April 6-9, 1959, Public Auditorium, Cleveland, Ohio. Preprint V-131. T. E. Free and M. A. Dewar (Lockheed Nuclear Products, Marietta, Ga.). New York, Engineers Joint Council, 1959. 13p. $0.50.

The Critical Experiment Reactor, a support facility for the Radiation Effects Reactor at the Georgia Nuclear Laboratory, became critical on June 9, 1958. Since that date it has been critical 211 times. Experiments conducted include critical experiments, rod calibrations, temperature coefficient determinations, void coefficient determinations, fuel content verification experiments, and miscellaneous reactivity determinations. (auth)

20673

MARCOULE'S REACTORS G2 AND G3. PART A, ACTIVE CORE AND VESSEL. Presented at Nuclear Engineering and Science Conference, April 6-9, 1959, Public Auditorium, Cleveland, Ohio. Preprint V-140. G. Deleuze and M. Tourasse. New York, Engineers Joint Council, 1959. 14p. $0.50.

Information is contained on the concrete envelope and reactor core. The graphite block and shield which maintain the core are discussed. (C.J.G.)

20674

MARCOULE'S REACTOR G2 AND G3. PART B, ON LOAD REFUELING. Presented at Nuclear Engineering and Science Conference, April 6-9, 1959, Public Auditorium, Cleveland, Ohio. Preprint V-141. A. Ertaud and A. Pages. New York, Engineers Joint Council, 1959. 10p. $0.50.

An account is given of the loading and unloading system in operation, under pressure of 15 kg. No movable mechanism is introduced inside the reactor. (C.J.G.)

20675

MARCOULE'S REACTORS G2 AND G3. PART D. CO_2 SUPPLY AND PROCESSING. Presented at Nuclear Engineering and Science Conference, April 6-9, 1959, Public Auditorium, Cleveland, Ohio. Preprint V-143. J. L. Hainzelin. New York, Engineers Joint Council, 1959. 5p. $0.50.

The CO_2 gas cooling circuit and the gas supplying plant are described. Continuous purification is provided each reactor. (C.J.G.)

20676

MARCOULE'S REACTORS G2 AND G3 PART E, REACTOR CONTROL. Presented at Nuclear Engineering and Science Conference, April 6-9, 1959, Public Auditorium, Cleveland, Ohio. Preprint V-144. M. Lignières and J. Bobigeat. New York, Engineers Joint Council, 1959. 10p. $0.50.

Information required for reactor operation coverage in the control room is presented. (C.J.G.)

20677

STROITEL'NYYE KONSTRUKTSII YADERNYKH REAKTOROV. (Structural Designs of Nuclear Reactor Plants.) Aleksandr Nikolayevich Komarovskii. Moscow, Atomizdat, 1958. 160p.

The results of experience in designing the structural portion of various types of nuclear reactors in the USSR and abroad are summarized. Site selection for nuclear plants, reactor shielding, and basic conditions for planning reactor buildings are described. In describing the structural portion of nuclear plants, some of the most successful design solutions are evaluated, and general principles proved by experience are presented. The basic conditions for structural design of reactor buildings for protection of personnel or surroundings are examined along with conditions of decontamination. A large section of the book is devoted to illustrations of Soviet and non-Soviet nuclear reactors. (TCO)

20678

NUCLEAR REACTOR PLANT DATA. VOLUME TWO. RESEARCH AND TEST REACTORS. New York, American Society of Mechanical Engineers, 1959. 304p.

Information is presented on 53 research reactors located in the U. S. and 42 reactors situated in Canada, South America, Western Europe, Asia, and Australia. The data are presented in a standardized form. It is felt that this will facilitate locating specific information quickly and generally aid in the use of the data. The form and organization is similar to that used in Power Reactors Volume I. (J.R.D.)

20679

MATERIALY JADERNYCH REAKTORŮ. (Nuclear Reactor Materials). Josef Zbořil. Prague, SNTL, 1958. 231p.

Fuels, structural, absorption, and shielding materials, moderators, coolants, and reflectors used in reactor technology are described. Their properties are given, as are requirements for application. Basic concepts of nuclear technology are listed, and isotopes are tabulated with their properties. The bibliographies at the end of each chapter indicate that the work is a survey based primarily on Western literature. The book is provided with numerous illustrations and tables. (auth)

20680

NUMERICAL METHODS FOR NUCLEAR REACTOR CALCULATIONS. Gurii Ivanovich Merchuk. Translation of Supplement Nos. 3-4 of Atomnaya Energ. New York, Consultants Bureau, Inc., 1959. 297p. $60.00.

This monograph is a discussion of the fundamental

problems arising when using numerical methods for nuclear reactor calculations. Particular attention is devoted to various practical applications. A prerequisite to the understanding of this monograph is familiarity with basic reactor theory as presented, for instance, by Glasstone and Edlund or Galanin. The book is intended for physics graduate students, doctoral candidates, engineers, and scientific workers specializing in nuclear reactor calculations. (auth)

20681

IMPROVEMENTS TO NUCLEAR REACTORS. H. C. Knights and H. Morris (to UK Atomic Energy Authority). British Patent 804,395. Nuclear Eng. 4, 324(1959) July-Aug.-Sept.

The temperature of the sheath material enclosing the nuclear fuel requires careful observation during reactor operation. In order to measure the temperature of the sheath accurately, thereby facilitating running at as high a temperature as possible with safety, a small thermocouple is placed in a suitable position on the surface of the sheath of the fuel element. The present invention is essentially concerned with a cable arrangement connecting the thermocouple on the element with a recording apparatus and is designed to form an integral part of a suitably constructed lifting arrangement for the individual fuel element.

Power

20682 ACNP-5918

Pennsylvania State Univ., University Park and Allis-Chalmers Mfg. Co. Atomic Energy Div., Milwaukee.
PATHFINDER ATOMIC POWER PLANT MEASUREMENTS OF NUCLEAR PARAMETERS OF BOILER AND SUPERHEATER LATTICES. Alan Jacobs and R. H. Vollmer. Aug. 31, 1959. 27p. For Northern States Power Co. and Central Utilities Atomic Power Associates. Contract AT(11-1)-589. $4.80(ph), $2.70(mf) OTS.

Experiments are described which were designed to yield information pertinent to the evaluation of the nuclear parameters of various fuel-moderator lattices in the environment of the Sioux Falls Power Reactor (Controlled Recirculation Boiling Reactor) core. The test lattice section was enclosed in an element which replaced one of the fuel elements of the Penn State Reactor. Parameters measured were U^{236} neutron capture cadmium ratio, space-averaged thermal neutron flux ratios, and reactivity coefficients. (W.D.M.)

20683 AECU-4256

Duquesne Light Co., Shippingport, Penna.
COMPONENT COOLING WATER SYSTEM. SECTION III. PART VI-F. THIRD PERFORMANCE. Test Results DL-S-117 (T-550071). First issue, June 3, 1959. 5p. $1.80(ph), $1.80(mf) OTS.

The test equipment and test procedure are described. The proper system flow rates were calculated. It was found that the summation of the individual cooling loops was 683 gpm while the main header flow indicated only 308 gpm. (auth)

20684 AECU-4258

Duquesne Light Co., Shippingport, Penna.
SAFETY RADIATION LEVEL SURVEY. SECTION II. FOURTH PERFORMANCE. Test Results DL-S-157. First issue, June 3, 1959. 7p. $1.80(ph), $1.80(mf) OTS.

The level of the radiation field in the non-nuclear portion of the plant during a significant power run was determined. The initial 100% power level survey showed a background radiation level of 0.02 mr/hr. This present survey was conducted at 103% power level, and no level greater than 0.02 mr/hr was detected. Therefore all radiation levels were equivalent to background level readings. (auth)

20685 AECU-4259

Duquesne Light Co., Shippingport, Penna.
INTERCALIBRATION OF NUCLEAR INSTRUMENTATION. SECTION IV. SECOND PERFORMANCE. Test Results DL-S-183 (T-612103). First issue, June 3, 1959. 6p. $1.80(ph), $1.80(mf) OTS.

The operating characteristics of the nuclear instrumentation with regard to the overlap between the source range and intermediate range with the reactor plant at 525°F and 1985 psig are determined. (auth)

20686 AECU-4260

Duquesne Light Co., Shippingport, Penna.
MEASUREMENTS OF COEFFICIENTS OF REACTIVITY. SECTION I. 300 EFPH. THIRD PERFORMANCE. Test Results DL-S-151 (T-550132). First issue, June 18, 1959. 42p. $7.80(ph), $3.30(mf) OTS.

The temperature and pressure coefficients of reactivity at zero power and 300 EFPH on the core were determined. The value of the temperature coefficient at the operating temperature of 523°F was determined to be 2.82 $(\Delta K/\Delta T) \times 10^{-4}$. The pressure coefficient was determined to be 2.70 $(\Delta K/\Delta P) \times 10^{-6}$ from 1200 psig to 2000 psig pressure (at 523°F temperature). It was found that information of a much higher quality was obtained during the test with a steam bubble in the pressurizer and by the use of the pressurizer as the primary system pressure controller. (auth)

20687 AECU-4264

Duquesne Light Co., Shippingport, Penna.
PERIODIC RADIATION SURVEY OF REACTOR PLANT CONTAINER AND COMPONENTS AFTER SHUTDOWN "F" SURVEY. SECTION IV. SECOND PERFORMANCE. Test Results DL-S-184 (T-612076). First issue, June 19, 1959. 4p. $1.80(ph), $1.80(mf) OTS.

A radiation level of 260 mr/hr was obtained inside the inlet hemispherical head of the 1D heat exchanger immediately after the hand holes were opened. Fifty-three and one-half hours later the radiation level inside the hemispherical head was 240 mr/hr. (auth)

20688 AECU-4266

Duquesne Light Co., Shippingport, Penna.
CORE I CONTROL ROD DRIVE MECHANISMS PERIODIC TESTS. SECTION I. TENTH PERFORMANCE. Test Results DL-S-148 (T-550011). First issue, June 22, 1959. 12p. $3.30(ph), $2.40(mf) OTS.

The operating condition of the rod drive mechanisms so that operating personnel may be informed concerning malfunctioning mechanisms was determined. The data obtained in the tenth performance of this test agree closely with the data obtained in the previous performance. The operating characteristics of the rod drive mechanisms checked in this test have not changed appreciably. (auth)

20689 AECU-4269

Duquesne Light Co., Shippingport, Penna.
GOVERNOR PERFORMANCE TESTS. SECTION IV. THIRD AND FOURTH PERFORMANCE. Test Results DL-S-174. First issue, July 6, 1959. 8p. $1.80(ph), $1.80(mf) OTS.

The determination of the operating characteristics of the governor valves is presented. (J.E.D.)

20690 AECU-4270
Duquesne Light Co., Shippingport, Penna.
XENON TRANSIENT. SECTION I. 145.4 EFPH. FIRST PERFORMANCE. Test Results DL-S-156 (T-612081). First issue, July 10, 1959. 16p. $3.30(ph), $2.40(mf) OTS.

Excess reactivity present in the core to override a peak xenon transient and to obtain data for rod worth calculations was determined. Enough excess reactivity was found to be available in the core to override a peak xenon transient (after 100% power operation) after 145.4 EFPH of operation. The override of peak xenon occurred approximately 8 hours and 52 minutes after shutdown with Group I control rods (1's, 3's, 5's, and 7's) withdrawn to 69 in. and Group II control rods (2's and 6's) withdrawn to 53 in. (auth)

20691 AECU-4275
Duquesne Light Co., Shippingport, Penna.
LOSS OF AC POWER FOLLOWING POWER OPERATION. SECTION I. FIRST PERFORMANCE. Test Results DL-S-227. First issue, July 8, 1959. 8p. $1.80(ph), $1.80(mf) OTS.

The adequacy of the emergency procedure for placing the diesel generator into operation upon loss of all a-c power was determined. The diesel generator capacity was found to be sufficient to meet all emergency requirements. It was determined that the plant limitations are exceeded upon complete loss of component cooling water. (auth)

20692 AECU-4276
Duquesne Light Co., Shippingport, Penna.
PERIODIC VALVE OPERATING SYSTEM PERFORMANCE TEST. SECTION I. SECOND PERFORMANCE. Test Results DL-S-216 (T-641114). First issue, July 10, 1959. 6p. $1.80(ph), $1.80(mf) OTS.

A test was made to determine whether the valve operating system, operating pressure, and water flask volume are sufficient to meet system requirements and also to check if leakage occurs through the three-way control valves. (auth)

20693 AECU-4278
Duquesne Light Co., Shippingport, Penna.
DETERMINATION OF PRIMARY SYSTEM PRESSURE DROP. SECTION I. SECOND PERFORMANCE. Test Results DL-S-147 (T-550129). First issue, July 6, 1959. 19p. $3.30(ph), $2.40(mf) OTS.

The reactor coolant system pressure drop and flow characteristics at periodic intervals throughout the life of the core were determined. (J.E.D.)

20694 AECU-4279
Duquesne Light Co., Shippingport, Penna.
REACTOR POWER AND TEMPERATURE CONTROL SYSTEM. SECTION I. FIRST PERFORMANCE. Test Results DL-S-291 (RNI-29A). First issue, July 6, 1959. 6p. $1.80(ph), $1.80(mf) OTS.

It was made certain that the built-in test signals in the intermediate range nuclear instrumentation can be used to align and check the P and T damping signal computer. (auth)

20695 AECU-4288
Duquesne Light Co., Shippingport, Penna.
DETERMINATION OF STEAM TEMPERATURE AND PRESSURE AT 75 PER CENT LOAD. SECTION I. FIRST PERFORMANCE. (RNI-33). Test Results DL-S-292-S. First Issue, July 10, 1959. 11p. $3.30(ph), $2.40(mf) OTS.

The actual values of the secondary system steam temperatures and pressures when the plant is operating at 75% power with either three or four loops in service and more than 3000 EFPH on Core I, Seed I, are determined. These temperatures and pressures will be used to determine per cent reactor power in lieu of performing a calorimetric measurement. This determination is intended to limit reactor power to 75% or less when xenon exceeds 125%. (auth)

20696 AECU-4302
Duquesne Light Co., Shippingport, Penna.
REACTOR POWER AND TEMPERATURE CONTROL SYSTEM. SECTION I. Test Results DL-S-128 (T-550082). Second issue, July 24, 1959. 8p. $1.80(ph), $1.80(mf) OTS.

Because of the noise detected when the time settings for the damping signal computer were changed, it is recommended that the power and temperature control system be taken out of the automatic position while making a time change during actual operation. The performance of the power and temperature control system components and the circuit integrity were satisfactory. Calibration of the ΔT and DO/PU potentiometers, elimination of noise from the damping signal computer and relay chatter, and installation of a variable resistance in the damping signal computer would improve these components. (auth)

20697 AECU-4323
Duquesne Light Co., Shippingport, Penna.
MONTHLY OPERATING REPORT. July 1959. 38p. Contract AT-11-1-292. $6.30(ph), $3.00(mf) OTS.

The Station was shutdown during the greater part of the month for maintenance and testing. Through the period of July 6 to July 12 the output varied from 0 to 47 Mw net for the Duquesne Light Company System capacity. Radiochemical data in the Chemistry report showed an increase in specific activity after power transients; and all boilers maintained reference water specifications under power operating conditions. In the Radioactive Waste Disposal System eleven chemical waste tanks and three surge tanks were sampled and processed to the environment. Health Physics was primarily concerned with control of contamination, radiation and personnel monitoring. New filters were installed in the gas scrubber improving the waste disposal stack discharge. Major repairs were performed on the turbine turning gear, gland exhaust condenser, and the moisture separator. Other maintenance items requiring extensive modifications were the steam relief valves and the power range linear amplifiers. In the test program a total of seventeen tests or sections of tests were performed. Nine of the twenty three tests scheduled were performed. Eight tests not scheduled were also performed. No test procedures were issued in final form, however five test procedures were issued in draft form. Also issued during the month were Test results, eighteen in final form and seven in draft form. (auth)

20698 APDA-132
Atomic Power Development Associates, Inc., Detroit.
TEMPERATURE RESPONSE TO POWER, INLET COOLANT TEMPERATURE AND FLOW TRANSIENTS IN SOLID FUEL REACTORS. Fred Storrer. June 5, 1959. 85p.

The study of the temperature response to power

transients in a nuclear reactor covers an important link in the closed feedback loop of reactor kinetics. It is a necessary step in the determination of the kinetic behavior and stability of a power reactor and in the interpretation of oscillator tests. Similarly, the temperature response to inlet coolant temperature transients is important in determining reactivity effects fed in through or fed back around the coolant loops. Flow transients also affect the kinetic behavior of a reactor. The analysis presented is valid for any solid fuel reactor in which there is little extraneous material besides fuel and coolant. An exact treatment of this problem consists in the solution of the transient heat transfer and heat conduction equations so as to yield the temperature at any point in the reactor at any time. In some cases, however, some simplifying assumptions can be made. These consist mainly in assuming that in those cases all or part of the temperature distribution does not depart much from what it is in steady state. Five models are considered in sucession. They are schematically represented. (auth)

20699 ATL-A-100

Advanced Technology Labs. Div. of American-Standard, Mountain View, Calif.

VARIABLE MODERATOR REACTOR DEVELOPMENT PROGRAM. Quarterly Progress Report No. 1. Aug. 31, 1959. 36p. Contract AT(04-3)-250. Project Agreement No. 3. $9.30(ph), $3.60(mf) OTS.

Development of the boiling water UO_2 fueled Variable Moderator Reactor (VMR) is conducted under contract for the USAEC. The initiation and progress of work under Phase I of the contract, "Physics and Kinetic Analysis and Initial Evaluation," and the preparation for Phase II, "Critical Experiment and Analysis of Results," are reported. A hydrodynamic flow sheet representing the sequence of calculations for the BOCH program was prepared. A preliminary block diagram of the kinetics model of the VMR was prepared. Work is reported on the PUREE code which is designed to give an accurate representation of the physics of the VMR core. A fuel element fabrication specification was prepared and released for quotations. A study was made to select the most appropriate material for void simulation throughout the range of interest in the VMR. (W.D.M.)

20700 BAW-1070

Babcock and Wilcox Co. Research Center, Alliance, Ohio.

LIQUID METAL FUEL REACTOR EXPERIMENT; CALIBRATION TESTS OF A PERMANENT-MAGNET ELECTROMAGNETIC FLOWMETER FOR LIQUID BISMUTH SERVICE. L. W. Yoder and B. L. Birch. Mar. 6, 1959. Changed from OFFICIAL USE ONLY July 31, 1959. 30p. Contract AT(30-1)-1940. $1.00(OTS).

A stainless steel section was inserted into a $\frac{3}{4}$-in. Croloy $2\frac{1}{4}$ loop; permanent magnets had been installed on both materials. Under isothermal test operation, flowmeter readings were taken every four hours over a period of about 2240 hr. Flow was calibrated using the flowmeter equation for stainless steel. Results show that the Croloy $2\frac{1}{4}$ flowmeter maintained constant calibration. Variations in bismuth temperature, however, changed the slope of the calibration curve. Magnetic materials were deposited from the stream at the magnet locations. (auth)

20701 BMI-919

Battelle Memorial Inst., Columbus, Ohio.

THE FABRICATION OF SUBASSEMBLIES FOR THE SUPERCRITICAL-WATER REACTOR. J. R. Keeler and A. W. Hare. Aug. 16, 1954. Decl. Aug. 10, 1959. 30p. Contract W-7405-eng-92. $4.80(ph), $2.70(mf) OTS.

In studies of the fabrication of fuel subassemblies for the supercritical-water reactor, the limited ductility of stainless steel–UO_2 fuel sheet made the fabrication of corrugated-flat-plate-type subassemblies impractical. A fabricable MTR-type assembly, $\frac{5}{8}$ in. square and 30 in. long, was developed. Methods for edge cladding fuel sheet were developed and a brazing alloy, GE-75, was found to be corrosion resistant in supercritical water. (auth)

20702 BMI-1288

Battelle Memorial Inst., Columbus, Ohio.

GCRE CRITICAL-ASSEMBLY STUDIES. David A. Dingee, William C. Ballowe, Raymond W. Klingensmith, Richard A. Egen, Francis J. Jankowski, and Joel W. Chastain. Sept. 10, 1958. Decl. July 24, 1959. 98p. Contract W-7405-eng-92. $15.30(ph), $5.40(mf) OTS.

Critical-assembly studies were made to provide engineering and physics data to aid in developing the Gas Cooled Reactor Experiment-1 (GCRE-1). Measurements of critical mass, flux and power distributions, and shutdown worth of the GCRE-1 mock-up safety and control blades were obtained. The critical assembly consists of aluminum tubes containing four concentric stainless steel cylinders wrapped with highly enriched uranium foil. These tubes are supported at each end by grid plates and arranged to approximate a right circular cylinder. The entire core structure is supported within a tank which can be filled remotely with moderator water. A void beneath the core structure and the air above it represent the gas plenums of the GCRE-1 reactor. Critical mass and flux power distributions were determined for several cases of four basic cores. The thermal utilization, measured in two core configurations, was 0.780 for the reactor without burnable poison or a lead reflector. The temperature coefficient of reactivity, measured in two cores, was positive at room temperature but negative in the proposed operating-temperature range. The total reactivity effect in going from 20 to 80°C was a positive 0.22% $\Delta k/k$. The worth of control and safety-shutdown blades of several compositions and sizes in various locations was determined for a number of core configurations; blades having a sandwich construction of cadmium, tungsten, and indium had the greatest shutdown worth. To date these studies have resulted in a 61-element core (critical with 54 elements) with a 4-in. lead reflector which has 2.5% $\Delta k/k$ excess reactivity for startup and for override of poison and burnup. A mock-up blade configuration has been determined which will control the excess reactivity introduced by flooding the elements with mineral oil (to simulate water flooding when fuel elements are changed in GCRE-1). (auth)

20703 CF-56-8-211

Oak Ridge School of Reactor Technology, Tenn.

REACTOR PRODUCING 3000°F STEAM FOR PROCESS HEAT. J. T. Roberts, J. S. Lagarias, F. J. Remick, R. W. Ritzmann, J. O. Roberts, W. J. Roberts, J. E. Schmidt, and P. R. Kasten. Aug. 1956. Decl. June 30, 1959. 202p. $31.80(ph), $9.30(mf) OTS.

A conceptual design is presented for a reactor producing 3000°F, 400 psi steam to supply process heat for high temperature endothermic chemical reactions. Specifically, the supplying of heat to a coal hydrogena-

tion plant is studied but other applications are possible. Such a market for nuclear heat is economically interesting because the competition is with the relatively expensive oxygen combustion of coal. It was assumed that in the present state of the art a ceramic heat source could not contain nuclear fuel in an open cycle due to the hazard of fission product leakage into the process stream. This assumption limited the high temperature heat source to the order of 10% of the total reactor power. The particular design studied was found to be not economically feasible due to the unusually large inventory of enriched uranium required. However, it is felt that with the suggested changes, nuclear process heat from this type of reactor could be competitive if the excess power produced could be sold economically. (auth)

20704 CF-59-8-2
Oak Ridge National Lab., Tenn.
CORE LEVITATION IN THE EGCR IN CASE OF MAIN COOLANT PIPE FAILURE. M. H. Fontana. Aug. 4, 1959. 38p. Contract [W-7405-eng-26]. $7.80(ph), $3.30(mf) OTS.

Results of an analysis to determine the extent of displacement of the EGCR core due to blowdown in case of several postulated hot main gas coolant pipe failures are summarized. Results show that the core will be damaged for any hot pipe double-ended failure. Excepting the improbable case of no coolant flow existing prior to the break, the core will be damaged for any hot pipe fracture exposing a total flow area to the atmosphere equal to that of one pipe. Smaller breaks will probably be safe in this respect. (auth)

20705 GEAP-0909
General Electric Co. Atomic Power Equipment Dept., [San Jose, Calif.].
ENCLOSURE PRESSURE CALCULATION METHOD. J. A. Bailey. Oct. 12, 1956. 11p. $3.30(ph), $2.40(mf) OTS.

A method of determining enclosure pressure in the event of a reactor rupture is presented and a sample calculation is shown. The method was used in calculating the design pressure of the Dresden Power Reactor enclosure. (auth)

20706 KAPL-M-SMS-101
Knolls Atomic Power Lab., Schenectady, N. Y.
WATER LEVEL CORRECTIONS FOR GAGE GLASS INSTALLATIONS IN NUCLEAR PLANT SERVICE. J. C. Westmoreland. July 23, 1959. 36p. Contract W-31-109-Eng-52. $6.30(ph), $3.00(mf) OTS.

The steady state gage glass correction factors that relate gage level to steam drum level were derived for nuclear plant service. They are presented in a manner such that the performance of a specific gage glass design can be predicted by using only the gage glass drawing and a curve of steam pressure as a function of load for the steam generator. The two major corrections to gage level as a result of thermal conditions are the density factor and the condensation factor. Under normal operating conditions the density factor is not entirely predicated by the physical design, however, the condensation factor should be reduced to a negligible amount by design. The gage glass performance is then basically dependent only upon the density correction factor. (auth)

20707 NAA-SR-Memo-1141
North American Aviation, Inc., [Downey, Calif.]
RODS, BALLS AND REACTOR SAFETY. James Emmett Garvey. Oct. 21, 1954. Decl. Nov. 6, 1958. 12p. $3.30(ph), $2.40(mf) OTS.

An analysis is made of the recent test of the ball safety device mock-up. The reactivity induced by the ball system is compared to that induced by solid rods; it is concluded that the balls compare so poorly to rods over the first five seconds after trip signal is given that improvements are well worth attempting. One such might be the use of one rod in addition to the ball system; the resultant response of such a system appears satisfactory. Moderate improvement in hopper design and method of channel-packing may also result in a satisfactory system and some possible improvements are discussed. (auth)

20708 NAA-SR-Memo-1282
North American Aviation, Inc., [Downey, Calif.].
TEST OF THE BALL SAFETY DEVICE MOCK-UP. E. Phillips. Feb. 22, 1955. Decl. Nov. 13, 1958. 21p. $4.80(ph), $2.70(mf) OTS.

The ball safety device mock-up was tested with the original type hopper gate and with the hinged hopper gate. With the original hopper gate and 44.1 lbs of balls, the thimble is full in 10.55 sec. With the hinged hopper gate with 36 lbs of balls, the thimble fills in 8.1 sec. (auth)

20709 NP-7757
Saxton Nuclear Experimental Corp., Reading, Penna.
APPLICATION TO U.S. ATOMIC ENERGY COMMISSION FOR REACTOR CONSTRUCTION PERMIT AND OPERATING LICENSE. PART B. PRELIMINARY HAZARDS SUMMARY REPORT. L. R. Finfrock, Jr., D. E. Hetrick, and D. R. Rees. [1959]. 143p. $21.30(ph), $6.90(mf) OTS.

The Saxton Nuclear Facility will consist of a 20 Mw(th) light water pressurized reactor, one primary coolant loop including one pump, one secondary heat removal system including one steam generator, steam piping, and feedwater system, required auxiliary systems, service building, and a vapor container. The steam generator will be designed to handle a core output of 28 Mw(th). Steam will be supplied to an existing 10 Mw turbine-generator. The core will contain 1270 kg of 3.7% enriched U in the form of UO_2 pellets in stainless steel tubes. (W.D.M.)

20710 NP-7873
Worthington Corp., Harrison, N. J.
LIGHTWEIGHT STEAM POWER CONVERSION SYSTEM. Final Comprehensive Technical Report. Jerome H. Rothenberg, George P. Clement, David Aronson, W. Hymer, and L. Mayer. Aug. 7, 1959. 247p. Project No. 8-86-00-000-K. Contract DA-44-192-ENG-10.

The design of a portable secondary cycle power plant to deliver 750 kw 400 cycle net electrical output, having a dry weight of 13,070 lb, is described. Steam is used as motive fluid obtaining heat from a once-through liquid metal boiler. The primary source of heat is a sodium cooled reactor. Heat is rejected in a compact air-cooled condenser bank. A 12,000 rpm generator, turbine, and boiler feed pump all mounted on the same shaft contributed to the design of a compact, light weight plant requiring a minimum of control. Simplicity in design is used throughout to make it possible for semi-skilled military personnel to operate it. The strong compact structure package is designed to withstand the normal abuse received during transportation with very little work required to put the plant into operation upon arrival at the site. Design is based on long life and ready servicing. (auth)

20711 ORNL-2767
Oak Ridge National Lab., Tenn.
GAS-COOLED REACTOR PROJECT SEMIANNUAL PROGRESS REPORT FOR PERIOD ENDING JUNE 30, 1959. Aug. 21, 1959. 227p. $3.50(OTS).

A steam-cooled water-moderated reactor for a 20,000-SHP plant for merchant ship propulsion was studied. It was concluded on the basis of the hazards involved that the system would be better suited to a central-station application. Two integrated gas-cooled reactor core and steam generator units that would utilize ceramic fuels were investigated. The fuel element surface and coolant gas temperatures were determined for various power density distributions in the PEGCPR. This reactor is designed with fixed orifices to match the coolant flow to the heat generated. A new model for determining the temperature gradients and the thermal stability of a rod cluster in a circular channel is being developed. A septafoil fuel element cluster in a coolant channel with a scalloped cross section was analyzed to determine whether the coolant flow with this geometry would improve the temperature distribution on the surface of the fuel elements. Calculations were made of the ideal core pumping power required for the pebble-bed and clustered-fuel-rod reactor core concepts. An analysis of the effect of thermal radiation in limiting the maximum fuel capsule temperatures during a loss of coolant accident in a GCR-2 type of reactor was performed on the Reactor Controls Analog Facility. A method was developed by which an accurate analysis may be obtained of the deflection and stresses in a beam of a grid structure if the interaction forces at the intersections of the cross beams are known. Tube buckling experiments are under way, and a curve of critical pressure as a function of unsupported length was obtained. The stresses and deflections in perforated plates were investigated experimentally. A study was made of the available information on helium ionization and electrical breakdown at high pressures and temperatures. A parametric study was made of the factors affecting containment vessel costs and size limitations. The fast neutron dose to the PEGCPR pressure vessel was calculated. A detailed study is being made of the worth of the B_4C control rods of the EGCR. Calculations were made to determine the effect the EGCR experimental loops will have on the neutron flux and thermal performance of the reactor core. Calculations were made to determine the validity of various models used to predict the power-density distribution within a cluster of steel-jacketed UO_2 fuel rods. The study of the contribution of spacers and hangers to the over-all pressure drop in a full-scale model of a fuel channel was continued. The effect of swirl-flow on surface velocity patterns in the septafoil geometry was investigated. An unexpected skewness in the circumferential temperature patterns observed in the heated-tube experiment led to the introduction of a weir in the entrance region. Naphthalene-to-air mass-transfer experiments were used to measure the heat transfer in septafoil geometries and to establish the effects of rod spacing ratios on the heat transfer. A thorough review was carried out on all design studies, specifications, and drawings for the Title I design of the PEGCPR. The experimental reactor is to be built at an Oak Ridge site, and is to be called the Experimental Gas Cooled Reactor (EGCR). A continuous double-calcination process was developed for the production of UO_2 powder of various enrichments for the irradiation program. A process was developed for the fabrication of UO_2 solid pellets with a density of 75% theoretical. A study on thermal conductivity and high-temperature deformation properties of UO_2 and the thermal stability of UO_2 dispersed in graphite is being conducted. The conditions that produce failure of type 304 stainless steel capsules from internal pressure were determined. An extensive program of creep testing of type 304 stainless steel in various geometries was initiated. The manufacturing variables involved in fabricating end closures for ETR and ORR fuel capsules were studied. A specification for the helium leak testing of capsules was completed. Inspection of Be and stainless steel tubing is described. The experimental facility for irradiation of full-diameter prototype fuel capsules in the ORR was completed. The He-cooled loop for operation in the GE Test Reactor was completed. Data on fission gas release show that below central operating temperatures of approximately 2250°F the ratio of radioactive gas existing outside the UO_2 pellet to the total existing at the time of sampling is small. Examinations of UO_2 pellets used in the fission gas release experiments revealed extensive cracks, but practically no dimensional changes. An instantaneous fission gas release experiment is described. Construction of the closed-cycle-loop facility for irradiations in the ORR was completed. Experiments have shown that irradiation has no significant effect on the thermal response of Chromel–Alumel thermocouples. The effects of fast neutron irradiation on steels and welds used in pressure vessel construction are being studied. Engineering-scale out-of-pile tests of reactor materials compatibility and fuel element structural integrity were continued. With one exception the samples of austenitic stainless steels exposed in these tests showed no surface changes other than a thin, tightly adherent, black oxide tarnish. Three low-pressure thermal-convection loop tests were completed. A 1000-hr test was completed in a forced-circulation loop in which the test section contained type TSF graphite and a simulated full-scale EGCR fuel element assembly. In the study of volumes and compositions of gases evolved from graphite the previously used temperature interval of 200 to 1000°C was extended to 2000°C, and larger samples were examined. The design study of a gas cooled loop for experimental studies in the ORR on advanced fuel elements was completed. Investigations are under way on gas compressors for producing the high fluid heads at low volumetric flows that are required for service applications such as the ORR gas cooled loop. (For preceding period see ORNL-2676.) (W.D.M.)

20712 PRDC-TR-23
Power Reactor Development Co., Detroit.
MONTHLY TECHNICAL REPORT [FOR] MAY 1959.
11p. Contract AT(11-1)-476. $3.30(ph), $2.40(mf) OTS.

The status of various research and development projects for the Fermi Fast Breeder Reactor is briefly summarized. (For preceding period see PRDC-TR-22.) (W.L.H.)

20713 PRDC-TR-24
Power Reactor Development Co., Detroit.
MONTHLY TECHNICAL REPORT [FOR] JUNE 1959.
9p. Contract AT(11-1)-476. $1.80(ph), $1.80(mf) OTS.

The status of various research and development projects for the Fermi Fast Breeder Reactor is briefly summarized. (For preceding period see PRDC-TR-23.) (W.L.H.)

20714 TID-7575
Division of Reactor Development, AEC.
D_2O MODERATED POWER REACTORS. A Symposium Held at the Atomic Energy Commission Headquarters Building, Germantown, Maryland, March 3-4, 1959. Mar. 1959. 158p. $1.50(OTS).

As part of a program of continuous review and evaluation by the Division of Reactor Development, the D_2O program is presently being evaluated, and this symposium is part of the evaluation. The question to decide is whether a reactor utilizing D_2O as a moderator offers cheaper power than those using other moderators with enriched uranium. (W.D.M.)

20715 TID-7575(p.3-5)
Nuclear Development Corp. of America, White Plains, N. Y.
REVIEW OF D_2O REACTOR STUDIES. John Menke. p.3-5 of D_2O-MODERATED POWER REACTORS. A Symposium Held at the Atomic Energy Commission Headquarters Building, Germantown, Maryland, March 3-4, 1959. 3p.

The first reason that one is interested in a D_2O reactor is that is it capable of operating on natural or slightly enriched uranium. Other motivations for operation on a D_2O and natural uranium base are discussed. Various technical designs are briefly described. The economics of D_2O reactors are considered in a general sense. (W.D.M.)

20716 TID-7575(p.6-10)
Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Aiken, S. C.
OPERATING PROBLEMS WITH D_2O. Dale F. Babcock. p.6-10 of D_2O-MODERATED POWER REACTORS. A Symposium Held at the Atomic Energy Commission Headquarters Building, Germantown, Maryland, March 3-4, 1959. 5p.

The work at Savannah River on uranium metal canned in zirconium or Zircaloy by the coextrusion process is summarized. Testing facilities of the Heavy Water Components Testing Reactor (HWCTR) are discussed. Some of the experience at Savannah River on the operation of D_2O-cooled reactors in the production field is given. (W.D.M.)

20717 TID-7575(p.11-14)
Division of Finance, AEC.
ACCOUNTING PARTICLES FOR D_2O IN POWER-REACTOR OPERATION. Edward Shepherd. p.11-14 of D_2O-MODERATED POWER REACTORS. A Symposium Held at the Atomic Energy Commission Headquarters Building, Germantown, Maryland, March 3-4, 1959. 4p.

In the AEC, heavy water is treated as an inventory item until such time as it is consumed in operations and charged to expense. However, when it is used as a moderator in a reactor, it is considered a fixed or capital asset. This is because the heavy water in the reactor will remain there so long as the reactor is in operation. A basis for computing annual fixed charges on D_2O investment in power reactor operations is discussed. (W.D.M.)

20718 TID-7575(p.15-22)
Oak Ridge National Lab., Tenn.
FUTURE REQUIREMENTS FOR D_2O. James A. Lane. p.15-22 of D_2O-MODERATED POWER REACTORS. A Symposium Held at the Atomic Energy Commission Headquarters Building, Germantown, Maryland, March 3-4, 1959. 8p.

Ultimately the emphasis in reactor design will move in the direction of systems with highest neutron economy because of increasing uranium requirements and decreasing resources. Therefore, because of the high neutron economy obtainable with a D_2O moderator, such reactors will occupy a definite segment of any future US power system. The possible magnitude of this segment and the corresponding D_2O requirements are indicated. (W.D.M.)

20719 TID-7575(p.23-7)
Atomic Energy Commission, Washington, D. C.
CAPABILITY OF AEC TO SUPPLY D_2O FOR FUTURE NEEDS. A. V. Butterworth. p.23-7 of D_2O-MODERATED POWER REACTORS. A Symposium Held at the Atomic Energy Commission Headquarters Building, Germantown, Maryland, March 3-4, 1959. 5p.

A capacity of 450 tons of heavy water per year is selected as the capacity of the Savannah River Plant, and the rise in installed electrical capacity resulting from operation of the plant at capacity is determined by assuming that the D_2O produced is used first to meet make-up requirements and then to supply initial inventory requirements for new heavy water power reactors. (W.D.M.)

20720 TID-7575(p.28-37)
Oak Ridge National Lab., Tenn.
COMPARISON OF FUEL-CYCLE COSTS IN D_2O- AND H_2O-MODERATED REACTORS. Paul R. Kasten. p.28-37 of D_2O-MODERATED POWER REACTORS. A Symposium Held at the Atomic Energy Commission Headquarters Building, Germantown, Maryland, March 3-4, 1959. 10p.

Some studies are described which were carried out at ORNL concerning fuel-cycle costs associated with H_2O and D_2O moderated reactors. The nuclear design of the H_2O reactor was similar to the Yankee Reactor design, whereas that of the D_2O reactor was patterned after the Carolinas–Virginia (Parr Shoals) Reactor concept. The D_2O reactor was assumed to use an organic coolant. Both the reactors were assumed to operate at a power level of 1200 Mw(th) and a net thermal efficiency of 25%. (W.D.M.)

20721 TID-7575(p.38-40)
Argonne National Lab., Lemont, Ill.
COMPARISON OF THE ECONOMIC MERITS OF D_2O AND OTHER MODERATORS. Leonard Link. p.38-40 of D_2O-MODERATED POWER REACTORS. A Symposium Held at the Atomic Energy Commission Headquarters Building, Germantown, Maryland, March 3-4, 1959. 3p.

The realization of the value of D_2O comes about in the design efforts which utilize the outstanding merits of D_2O. Some of these advantages that may be obtained with proper design are given. The influence of D_2O on power-production costs is shown. Five cases covering three H_2O and two D_2O reactors are compared in terms of core loading, enrichment, uranium core, and fabrication cost charge. (W.D.M.)

20722 TID-7575(p.41-8)
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
SELECTED ECONOMIC ASPECTS OF PLUTONIUM-FUEL UTILIZATION IN D_2O-MODERATED REACTORS. J. R. Triplett. p.41-8 of D_2O-MODERATED POWER REACTORS. A Symposium Held at the Atomic Energy Commission Headquarters Building, Germantown, Maryland, March 3-4, 1959. 8p.

The fuel cycle analysis program at Hanford has, for the most part, treated reactor parameters in general terms. Some general conclusions are drawn from the work which are relevant to the comparison of fuel cycle costs in specific reactors of the D_2O, H_2O, or graphite moderated types. Only the fuel cycle costs were studied. The fuel cycles considered are thermal nonbreeders. The charged fissile materials for these cycles are U^{235}, Pu^{239}, and Pu^{241} and the fertile materials are U^{238} and Pu^{240}. (W.D.M.)

20723 TID-7575(p.49-59)
Nuclear Development Corp. of America, White Plains, N. Y.
SODIUM-DEUTERIUM REACTOR PROGRAM. Edward Bernsohn. p.49-59 of D_2O-MODERATED POWER REACTORS. A Symposium Held at the Atomic Energy Commission Headquarters Building, Germantown, Maryland, March 3-4, 1959. 11p.

The SDR program objectives are twofold: thermal economy and neutron economy. It is hoped to achieve these objectives through the use of heavy water moderator and sodium coolant. The goal of the program is economic power from central power stations using natural uranium. The design features, problems, and economic potential of the SDR are discussed. Work on high-conversion reactors is indicated. (W.D.M.)

20724 TID-7575(p.60-70)
Westinghouse Electric Corp., Pittsburgh.
D_2O-COOLED AND -MODERATED PRESSURE-TUBE REACTOR PROGRAM. W. E. Abbott. p.60-70 of D_2O-MODERATED POWER REACTORS. A Symposium Held at the Atomic Energy Commission Headquarters Building, Germantown, Maryland, March 3-4, 1959. 11p.

The CVNPA will erect a nuclear power plant at Parr, South Carolina, where a conventional steam-electric power plant already exists. The reactor has been designated the Carolinas–Virginia Tube Reactor (Parr Shoals Power Reactor). The program will consist of three phases: a preconstruction research and development phase; a construction phase; and a post construction research and development phase. Technical aspects, objectives, and safety of the plant are discussed. (W.D.M.)

20725 TID-7575(p.71-2)
East Central Nuclear Group.
ECNG-FWCNG OBJECTIVES FOR THE ADVANCEMENT OF THE GAS-COOLED D_2O-MODERATED PRESSURE-TUBE REACTOR. W. L. Webb. p.71-2 of D_2O-MODERATED POWER REACTORS. A Symposium Held at the Atomic Energy Commission Headquarters Building, Germantown, Maryland, March 3-4, 1959. 2p.

The objectives of the East Central Nuclear Group-Florida West Coast Nuclear Group (ECNG-FWCNG) in selecting the pressure tube concept are discussed. In the selection the dominant objectives were low fuel cost potential, no inherent limit in unit capacity, and high thermal efficiency to reduce fuel costs and reactor capital investment. The gas coolant is presently visualized as CO_2. (W.D.M.)

20726 TID-7575(p.73-83)
General Nuclear Engineering Corp., Dunedin, Fla.
GAS-COOLED D_2O-MODERATED PRESSURE-TUBE REACTOR PROGRAM. G. M. Roy. p.73-83 of D_2O-MODERATED POWER REACTORS. A Symposium Held at the Atomic Energy Commission Headquarters Building, Germantown, Maryland, March 3-4, 1959. 11p.

A summary status of the engineering and development for the East Central Nuclear Group-Florida West Coast Nuclear Group gas-cooled D_2O-moderated prototype reactor is given. Background information is given relative to the reasons for selection of D_2O as a moderator and the features which characterize the reactor design. Principal technical problems are considered. (W.D.M.)

20727 TID-7575(p.84-91)
Oak Ridge National Lab., Tenn.
OBJECTIVES AND POTENTIAL OF AQUEOUS HOMOGENEOUS REACTORS. James A. Lane. p.84-91 of D_2O-MODERATED POWER REACTORS. A Symposium Held at the Atomic Energy Commission Headquarters Building, Germantown, Maryland, March 3-4, 1959. 8p.

The development of aqueous homogeneous power reactors has long been considered worthwhile as a means of achieving lower fuel-cycle costs than that possible with solid-fuel reactors and increasing the utilization of nuclear source materials by breeding. The objectives and potential of aqueous homogeneous reactors are discussed in terms of fuel-cycle costs and comparative material requirements for various reactor types. (W.D.M.)

20728 TID-7575(p.92-107)
Sargent and Lundy, Chicago.
NATURAL URANIUM–D_2O POWER REACTOR STUDY. W. A. Chittenden. p.92-107 of D_2O-MODERATED POWER REACTORS. A Symposium Held at the Atomic Energy Commission Headquarters Building, Germantown, Maryland, March 3-4, 1959. 16p.

The objectives, potentials, and conclusions that were developed in the heavy water-moderated power reactor design study by Sargent and Lundy are discussed. The principal objectives of the study were to recommend a conceptual design which would offer the most promise for economic power in the near future and to prepare a preliminary design and cost estimate for a prototype of the minimum size necessary to demonstrate the recommended concept. Six reactor concepts were studied. (W.D.M.)

20729 TID-7575(p.108-26)
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
ORGANIC-COOLED D_2O-MODERATED POWER-REACTOR STUDY. B. L. Hoffman. p.108-26 of D_2O-MODERATED POWER REACTORS. A Symposium Held at the Atomic Energy Commission Headquarters Building, Germantown, Maryland, March 3-4, 1959. 19p.

A design study is described which was initiated to select, from several organic cooled reactor designs, the combination of moderator and fuel which showed the potential of producing the lowest total power cost. The D_2O system was unique among those investigated since it was the only one which offered the advantage of a natural uranium fuel cycle. The salient features of the D_2O reactor concept developed for comparison with other moderator systems are described. (W.D.M.)

20730 TID-7575(p.127-35)
Argonne National Lab., Lemont, Ill.
D_2O-MODERATED BOILING-WATER REACTOR. Joe Thie. p.127-35 of D_2O-MODERATED POWER REACTORS. A Symposium Held at the Atomic Energy Commission Headquarters Building, Germantown, Maryland, March 3-4, 1959. 9p.

It has been pointed out that boiling heavy water reactors are economically promising in large sizes. The technical status of this reactor concept is discussed in

relation to what has been done at ANL and Halden. Special problems of boiling heavy water reactors are considered. Results obtained from mock-up ZPR-VII are summarized. (W.D.M.)

20731 TID-8500

Ebasco Services, Inc., New York and General Electric Co. Atomic Power Equipment Dept., San Jose, Calif.

BOILING WATER REACTOR STUDY. PART 1. 306 MW POWER REACTOR CONCEPTUAL DESIGN. Mar. 1959. PART 2. SEPARATE STUDIES. Mar. 1959. PART 3. 306 MW COAL-FIRED INSTALLATION. Apr. 1959. Issued in three parts: 322p. (Pt. 1); 167p. (Pt. 2); and 39p. (Pt. 3). Contract AT(10)-1010. $5.25(OTS).

Pts. 1, 2, and 3 previously available as IDO-24030 (Vols. 1 and 2), IDO-24030 (Separate Studies 1 through 10), and IDO-24031, respectively.

The objective of this study is to provide for the development of the conceptual design criteria for the "most promising" type of BWR and associated complete electrical generating plant consistent with a schedule calling for start of construction in July 1960. Part one summarizes the results of the study, including principal facts and conclusions. Part two covers the technical and economic findings of the study in greater detail. Ten separate studies were prepared, each of which supplements technical data included in part one. Part three sets forth the results of a study of a typical 306 Mw(e) coal-fired installation for comparison with the BWR. Energy costs at 1959 levels were estimated at 7.03 and 8.3 mills/kwh for the coal-fired plant and the BWR. (W.D.M.)

20732 TID-8501

Bechtel Corp., San Francisco and Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

ORGANIC COOLED REACTOR STUDY. PART 1. SUMMARY OF STUDY. Mar. 1959. Revised Apr. 1959. PART 2. 300 MW POWER PLANT CONCEPTUAL DESIGN. Mar. 1959. PART 3. REACTOR CONCEPT EVALUATION. Mar. 1959. PART 4. 75 MW POWER PLANT CONCEPTUAL DESIGN. Apr. 1959. PART 5. 300 MW COAL-FIRED POWER PLANT COMPARISON STUDY. Apr. 1959. Issued in five parts: 112p. (Pt. 1); 475p. (Pt. 2); 322p. (Pt. 3); 422p. (Pt. 4); and 101p. (Pt. 5). Contract AT(11-1)-708. $15.00(OTS).

Pts. 1, 2, 3, 4, and 5 previously available as BCPI-1 (Vol. 1), BCPI-1(Vol. 2), BCPI-1(Vol. 3), BCPI-1(Vol. 4), and BCPI-1, respectively.

Various design possibilities and variations thereof are evaluated to determine the specific concept and size most likely to result in economic power generation. A conceptual design is prepared in sufficient detail to estimate capital costs, fuel cycle costs, operating costs, research and development work required, and operating characteristics. The reductions in ultimate costs that might be achieved by multiple units are evaluated. A parallel conceptual design and evaluation effort on a 75 Mw(e) organic cooled and moderated reactor is reported. The results of a study to compare the costs for a conventional fossil fueled power plant with an OCMR power plant are presented. Based on 1963 costs, the power generation costs are 6.77, 8.12, and 13.12 mills/kwh for a 300 Mw(e) coal-fired plant, a 300 Mw(e) OCMR plant, and a 75 Mw(e) OCMR plant, respectively. (W.D.M.)

20733 TID-8502

Stone and Webster Engineering Corp., [Boston] and Combustion Engineering, Inc., [New York].

ADVANCED PRESSURIZED WATER REACTOR STUDY. PART 1. PHASE I REPORT. PART 2. APPENDIXES TO PHASE I REPORT. PART 3. 235 Mw COAL-FIRED GENERATING PLANT. Apr. 1959. Issued in three parts: 559p. (Pt. 1); 499p. (Pt. 2); and 23p. (Pt. 3). Contract AT(11-1)-709. $10.75(OTS).

Pts. 1, 2, and 3 previously available as SW-1(Vol. 1), SW-1(Vol. 2), and SW-1, respectively.

The results of a study made to evaluate the most promising design of a pressurized water reactor and turbine generator plant are presented. A plant size was developed of 248 Mw(e) capability which gives a net station output of slightly over 236 Mw(e). The plant is a heterogeneous light water cooled and moderated pressurized water reactor with a gross heat output of 685 Mw(th). The core is of two-radial zone design with stainless steel clad uranium oxide fuel elements containing boron burnable poison to minimize mechanical control requirements. A study was made to determine the construction and operating costs of a comparable coal-fired plant. Power generation costs of 7.10 and 8.26 mills/kwh are estimated for the conventional and nuclear plants. (W.D.M.)

20734 TID-8503

Sargent and Lundy, Chicago and Nuclear Development Corp. of America, White Plains, N. Y.

HEAVY WATER MODERATED POWER REACTOR PLANT. PART 1. DESIGN STUDY. PART 2. PRELIMINARY DESIGN OF THE PROTOTYPE PLANT. Apr. 1959. Issued in two parts: 618p. (Pt. 1) and 482p. (Pt. 2). Contract AT(38-1)-193. $11.25(OTS).

Pts. 1 and 2 previously available as SL-1565(Vols. 1-3 and Add. 1) and SL-1581(Vols. 1-3), respectively.

The full-scale plant recommended as a result of a study of six D_2O moderated concepts utilizes a direct cycle, boiling D_2O reactor-turbine system to produce 208 Mw(e) net output. D_2O steam is produced in the tubes of a pressure tube type reactor. Power production costs are 12.609 and 11.181 mills/kwh for natural and enriched uranium. A preliminary design of a 65 Mw(e) prototype plant is presented. (W.D.M.)

20735 TID-8504

Division of Reactor Development, AEC.

AEC SUMMARY AND EVALUATION REPORT OF FOUR POWER REACTOR DESIGN STUDIES. Aug. 1959. 37p. $0.60(OTS).

Four reactor design and engineering studies recently completed for the AEC are summarized and evaluated. Reports submitted by the four contractors are analyzed, and consideration is given to differences in costing practices, differences in plant composition, and differences in components of cost estimates. An attempt is made to place the results on a somewhat more comparable basis. Areas of debatable technical judgment are identified, and the effects of other assumptions in these areas are indicated. (W.D.M.)

20736 UMRI-2431-5-F

Michigan, Univ., Ann Arbor, Research Inst.

TEST ON MODELS OF NUCLEAR REACTOR ELEMENTS, V. HEAD LOSSES IN CORE SUBASSEMBLY "C" AND MISCELLANEOUS TESTS. Final Report. A. C. Spengos. Aug. 1959. 33p. For Atomic Power Development Associates, Inc.

Head losses were determined for flow through core sub-assembly "C" consisting of an entrance nozzle, a lower axial blanket section, the core section, an upper axial blanket section, and a short section containing the handling lug. Miscellaneous tests were conducted for (a) the determination of the head loss in the hydraulic

model of a nuclear element (to be tested in SRE) and the control of the flow through this model with orifices, (b) the division of flow in a core section with an inner envelope, (c) the determination of the head loss in a core section with spiral springs as spacers, (d) the comparison of head losses in the nozzle and lower blanket sections of the first and second axial blanket subassemblies, and (e) the determination of the head-loss coefficient for distributing orifices of various sizes mounted in a model of a pair of nozzles of the outer radial blanket. (auth)

20737 WAPD-NCE-1793

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

REPORT ON THE DEVELOPMENT OF PWR FUEL ELEMENT MANUFACTURING PROCEDURE. W. E. Zupon. Sept. 6, 1956. Decl. Aug. 25, 1958. 12p.

PWR Core I Seed I fuel elements were successfully fabricated to comply with design specifications and requirements. Described are the composite results of several individual pre-production runs involving the investigation of enriched vs. natural fillers, hot rolling vs. hot rolling and cold rolling, surface roughness, alignment of locating holes by the scribed center-line method vs. self-centering method, components, assembling procedure, fuel element dimensional survey, rolling schedule, rolling temperature, and bulging in web thickness. (auth)

20738 YAEC-137

Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh.

OPERATION AND TESTING OF THE YANKEE UNIVERSAL FUEL HANDLING TOOL. L. J. Balog. June 1959. 40p. For Yankee Atomic Electric Co. Contract AT(30-3)-222, Subcontract No. 1. $7.80(ph), $3.30(mf) OTS.

The Universal Handling Tool represents the implement with which the core of the Yankee plant will be initially loaded and subsequently unloaded and refueled. With the objectives of reducing refueling time to a minimum and simplifying the refueling operation in general, the universal handling concept was conceived and developed. The Universal Handling Tool, which is capable of manipulating guide tubes, drive shafts, control rods, control rod followers and fuel assemblies, overcomes the need of requiring several tools to accomplish handling of these various reactor components. Consequently, an appreciable savings in time is realized since the time associated with changing tools, in the multi-tool concept, to handle each specific component group does not exist. Tests were performed on the Universal Handling Tool to establish its practicality for application in the Yankee plant. A maximum load test was carried out to establish the ability of the tool to lift and support more than five (5) times the load represented by the weight of a fuel assembly. A fuel assembly is the heaviest reactor element that the tool will manipulate in the plant. Further testing included the manipulation of mocked-up versions of each of the reactor components that the tool will be called upon to handle in the Yankee plant. This phase of testing was carried out underwater in the WAPD deep pit facility to simulate actual refueling conditions in the plant. (auth)

20739 AEC-tr-3786

[PROCESS FOR THE TRANSFORMATION OF NUCLEAR ENERGY TO ELECTRIC ENERGY]. Translation of German Patent 1,021,962: January 2, 1958. 5p. $1.80 (ph); $1.80(mf) JCL.

The object of the invention is a process for the transformation of nuclear energy to electric energy which involves using the nuclear energy directly for heating one half of the junctions of the elements of a thermoelectric arrangement which is contained within the core of a nuclear reactor. The thermoelectric components are composed of moderator and fuel, and various cooling schemes for cooling at the non-heated zone are provided for. (W.D.M.)

20740

THE STABILITY OF A NUCLEAR POWER PLANT. A. S. Kochenov. Atomnaya Energ. 7, 122-8(1959) Aug. (In Russian)

The stability of a nuclear power plant consisting of a water-moderated and -cooled reactor with a negative temperature coefficient of reactivity, steam generator producing saturated steam, and turbines is studied. It is assumed that the system has only two controls; the throttle control in front of the turbine and constant water level control at the steam generator. Single group kinetic equations are used with considerations for one group of slowed down neutrons. The studies were developed with low perturbation parameters. Non-linear equations are linearized, and the solution for the stability of the installation is derived. (tr-auth)

20741

AGR BOILERS. E. F. P. Bennett. Nuclear Eng. 4, 291-3(1959) July-Aug.-Sept.

Design, control, major reactor parameters, and steam cycle data are presented for the Advanced Gas Cooled Reactor at Windscale. (C.J.G.)

20742

ENGINEERING COMPARISONS. S. Baron (Burns and Roe, Inc., New York). Nucleonics 17, No. 8, 60-2(1959) Aug.

Of four power reactor concepts studied, three (PWR, BWR, and OMR) are related to reactors that are near or under construction (Yankee, Dresden, and Piqua). Comparison of these advanced concepts with their present-day counterparts reveals engineering improvements resulting in core performance and thermal efficiency. No significant improvement is made on primary coolant systems. (C.J.G.)

20743

D_2O—NATURAL URANIUM REACTOR. G. F. Hoveke (Sargent & Lundy, Chicago) and J. DeFelice (Nuclear Development Corp. of America, White Plains, N. Y.). Nucleonics 17, No. 8, 63(1959) Aug.

A comparison of all D_2O moderated reactors that can operate on natural-U fuel reveals the direct-cycle boiling D_2O concept with a pressure-tube core to be the most advantageous. (C.J.G.)

20744

EVALUATION OF THE ARMY PACKAGE POWER REACTOR FAMILY. Presented at Nuclear Engineering and Science Conference, April 6-9, 1959, Public Auditorium, Cleveland, Ohio. Preprint V-55. J. G. Gallagher (Alco Products Inc., Schenectady, N. Y.). New York, Engineers Joint Council, 1959. 23p. $0.50.

The evolution of the Army Package Power Reactor family from the APPR-1 through the APPR-1a to the skid-mounted APPR is presented. The design features and characteristics of the reactor core and vessel are presented. The shielding, primary system, vapor containment, and secondary system are discussed. (auth)

20745
DESIGN OF A 10 MW_e SODIUM DEUTERIUM REACTOR POWER PLANT. Presented at Nuclear Engineering and Science Conference, April 6-9, 1959, Public Auditorium, Cleveland, Ohio. Preprint V-56. James G. Duffy, Charles C. Graves, and Edgar D. Oppenheimer (Nuclear Development Corp. of America, White Plains, N. Y.). New York, Engineers Joint Council, 1959. 23p. $0.50.

The Sodium Deuterium Reactor is a central station power reactor which is cooled by sodium and moderated by D_2O. This reactor and its associated systems and plant facilities are described as designed. (auth)

20746
THE POTENTIAL OF ORGANIC-COOLED HEAVY-WATER REACTORS FOR ECONOMIC POWER GENERATION. Presented at Nuclear Engineering and Science Conference, April 6-9, 1959, Public Auditorium, Cleveland, Ohio. Preprint V-57. Malcolm J. McNelly (Canadian General Electric Co., Ltd., Peterborough, Ont.). New York, Engineers Joint Council, 1959. 28p. $0.50.

An organic-cooled heavy-water reactor is described. An analysis is made of the improvements in the design of this unit over current heavy-water reactor designs and organic-cooled and -moderated reactor designs. Finally, the estimated cost of power from a 250 Mw plant of this type is shown to be 5 to 8 mills/kwhr. (auth)

20747
ACCEPTANCE TESTING OF NUCLEAR POWER PLANTS. Presented at Nuclear Engineering and Science Conference, April 6-9, 1959, Public Auditorium, Cleveland, Ohio. Preprint V-62. W. H. Hamilton and G. H. Conley (Westinghouse Electric Corp., Pittsburgh). New York, Engineers Joint Council, 1959. 28p. $0.50.

Acceptance testing of pressurized water reactor power plants is discussed. Emphasis is placed on problems which are departures from those encountered in conventional plants. The significant events in the test program are described and important considerations identified. Problems in planning, executing, and evaluating the test program are mentioned. (auth)

20748
THE HUNTERSTON PROJECT AND THE FUTURE DEVELOPMENT OF THE GAS-COOLED POWER REACTOR. Presented at Nuclear Engineering and Science Conference, April 6-9, 1959, Public Auditorium, Cleveland, Ohio. Preprint V-63. Kenneth J. Wootton (General Electric Co., Ltd., Erith, Kent, Eng.). New York, Engineers Joint Council, 1959. 26p. $0.50.

The present status of the 320 Mwe gas-cooled reactor plant now under construction at Hunterston, Scotland, is described. Attention is directed at certain design features. The future development of power reactors in Britain is discussed with particular reference to engineering aspects of the gas-cooled, graphite-moderated system. (auth)

20749
THE BERKELEY NUCLEAR POWER STATION AND ITS INFLUENCE ON FUTURE DEVELOPMENTS. Presented at Nuclear Engineering and Science Conference, April 6-9, 1959, Public Auditorium, Cleveland, Ohio. Preprint V-64. A. L. Shaw (A. E. I. John Thompson Nuclear Energy Co., Ltd., Knutsford, Eng.). New York, Engineers Joint Council, 1959. 39p. $0.50.

An account is given of the background to design of the Berkeley nuclear power station. Some characteristic design features are discussed, and site construction methods and progress up to January 1, 1959, are reported. Subsequent developments of this type of reactor design are indicated to date and beyond. (auth)

20750
NUCLEAR CALCULATIONS FOR A CONTINUOUSLY FUELED PEBBLE BED REACTOR. Presented at Nuclear Engineering and Science Conference, April 6-9, 1959, Public Auditorium, Cleveland, Ohio. Preprint V-81. Raymond O. Bagley, Jr. (Alco Products, Inc., Schenectady, N. Y.). New York, Engineers Joint Council, 1959. 30p. $0.50.

Equations are presented for determining the equilibrium isotope distribution as the fuel moves axially through the core. These are used in conjunction with multigroup slowing-down theory and modified two group perturbation theory to determine the change in reactivity of the continuously fueled reactor relative to an unperturbed reference reactor. The results of these calculations using fuel element transit times of 100 and 150 days are presented. (auth)

20751
THE BUILDUP OF RADIOACTIVITY IN THE PRIMARY SYSTEM OF THE ARMY PACKAGE POWER REACTOR. Presented at Nuclear Engineering and Science Conference, April 6-9, 1959, Public Auditorium, Cleveland, Ohio. Preprint V-118. William S. Brown (Alco Products, Inc., Schenectady, N. Y.). New York, Engineers Joint Council, 1959. 15p. $0.50.

The buildup of radioactivity on samples of Type 304 stainless steel, Croloy 16-1 steel, and carbon steel exposed to the reactor coolant is described. For equal exposure periods, Croloy 16-1 was found to accumulate the greatest activity. The coolant temperature has a marked effect upon the activity accumulated by the samples. (auth)

20752
INSPECTION & MAINTENANCE EXPERIENCE WITH HRE-2. Presented at Nuclear Engineering and Science Conference, April 6-9, 1959, Public Auditorium, Cleveland, Ohio. Preprint V-120. J. S. Culver, D. M. Shepherd, and C. W. Collins (Oak Ridge National Lab., Tenn.). New York, Engineers Joint Council, 1959. 23p. $0.50.

Experience in replacement of highly radioactive components of Homogeneous Reactor Experiment No. 2 is discussed, with particular emphasis on containment of air-borne contamination and control of personnel exposure. The design and operation of tools and viewing devices developed to observe the hole in the HRE-2 core tank are described. (auth)

20753
OMRE OPERATING EXPERIENCE. Presented at Nuclear Engineering and Science Conference, April 6-9, 1959, Public Auditorium, Cleveland, Ohio. Preprint V-121. N. J. Swanson and D. R. Muller (Atomics International, Idaho Falls, Idaho). New York, Engineers Joint Council, 1959. 22p. $0.50.

Pre-operational testing, critical assembly, low power physics experiments, and a total of 950 Mwd of power operation of the OMRE have been completed. During this period the concept of organic moderated and cooled reactors for commercial use has been proven to be technically and economically feasible. (auth)

20754
MAJOR AND UNIQUE FACTORS CONTROLLING THE CONSTRUCTION SCHEDULING OF THE DRESDEN

NUCLEAR POWER STATION. Presented at Nuclear Engineering and Science Conference, April 6-9, 1959, Public Auditorium, Cleveland, Ohio. Preprint V-134. Fred A. Hollenbach (General Electric Co., Schenectady, N. Y.) and Ray B. Owens (Bechtel Corp., San Francisco). New York, Engineers Joint Council, 1959. 27p. $0.50.

The work sequencing and scheduling utilized in the construction of the nuclear reactor steam generating system of the Dresden Nuclear Power Station is discussed with emphasis placed on unique construction practices and scheduling requirements due to inherent design features of a nuclear power plant. Major areas discussed are the reactor containment sphere, the structural and shielding construction within the sphere, the erection of the reactor pressure vessel and other major nuclear steam supply equipment, and the pre-operational system cleaning and testing. (auth)

20755

SOLID STATE PHYSICS. VOLUME 8. ADVANCES IN RESEARCH AND APPLICATIONS. Frederick Seitz and David Turnbull, eds. New York, Academic Press, 1959. 529p.

Articles are presented on electronic spectra of organic crystals, photoconductivity in Ge, interaction of thermal neutrons in solids, electronic processes in zinc oxide, and structure and properties of grain boundaries. (W.D.M.)

STABLE ISOTOPE SEPARATION

20756 AECD-4238

Columbia Univ., New York.

LABORATORY STUDIES FOR SEPARATION PROCESSES. CHAPTER 7. DUAL-TEMPERATURE PROCESSES—SULFIDE SYSTEM. Maxwell L. Eidinoff. APPENDIX. EQUILIBRIUM CONSTANTS FOR EXCHANGE REACTIONS INVOLVING HYDROGEN SULFIDE. 1951. Decl. Feb. 1, 1957. 97p. (NNES-III-4D(Chap. 7 and App.).) $15.30(ph), $5.40 (mf) OTS.

NNES-III-4D, with the exception of Chapter 7 and the Appendix, is essentially duplicated by the unclassified, published volume, NNES-III-4F.

Measurements and calculations of the equilibrium constant for the hydrogen sulfide-water-deuterium exchange reaction are described. Analysis of plant operating conditions is given. Inasmuch as it appeared certain that a large-scale plant would employ bubble-cap plates, it was necessary to determine bubble-slot-plate efficiencies over a range of gas velocities and pressures. The results of these studies are presented. It was immediately evident that serious hydrogen sulfide corrosion problems would have to be overcome. A number of stainless steels would have been immediately suitable as materials for plant construction. Unfortunately it appeared reasonably certain that several thousand tons of special noncorroding steels would not be available for the duration of the war. The studies made to resolve this difficulty are described. In order to acquire valuable experience that would be useful in the operation of a stainless steel pilot plant (then in the design stage) a small glass dual-tower unit was constructed and operated. This unit is described. Larger scale development included the design and partial construction of a stainless steel semiworks plant comprising three stages of packed towers operating in cascade. Its purpose was to develop operating techniques, to provide essential design data, and to permit design changes before the completion of a full-scale plant. Vessels and towers were in place, and construction was practically completed by Apr. 20, 1943, at which time operations were suspended. This plant is briefly described. (auth)

20757 NYO-180

Hydrocarbon Research Inc., New York.

THE IMPROVED DUAL TEMPERATURE PROCESS FOR THE PRODUCTION OF HEAVY WATER. REVIEW OF REPORT NYOO-85. M. Benedict, S. Golden, and W. J. Norton. Jan. 6, 1950. Decl. Feb. 27, 1957. 20p. Contract AT(30-1)-697. $3.30(ph), $2.40(mf) OTS.

A description and evaluation of a process for the production of heavy water at low cost by the hydrogen sulfide-water dual-temperature method are presented. (W.L.H.)

20758 NYO-681

Girdler Corp. Gas Processes Div., Louisville, Ky.

DUAL-TEMPERATURE HEAVY WATER PROCESS EVALUATION OF PROPOSED TESTING AND PRODUCTION PROGRAM AT WABASH RIVER ORDNANCE WORKS. Apr. 21, 1950. Decl. Feb. 27, 1957. 60p. Contract AT(30-1)-857. $9.30(ph), $3.60(mf) OTS.

A proposal that existing facilities previously used for the production of D_2O by distillation be converted for pilot plant testing of the Dual-Temperature Process was evaluated. Conversion and production cost estimates are given and compared with construction and production cost estimates for a high-pressure Dual-Temperature Process. (D.E.B.)

20759 NYO-7523

Esso Research and Engineering Co., Linden, N. J.

DEUTERIUM SEPARATION STUDY. Progress Report No. 4. [Final Report on HEAVY WATER MANUFACTURE SURVEY]. Frank T. Barr and W. P. Drews. Oct. 14, 1955. Decl. Mar. 25, 1957. 21p. Contract [AT(30-1)-1407]. (SOA-188). $4.80(ph), $2.70(mf) OTS.

Attached to this report is a letter containing pertinent data to Morris Goldberg from Frank T. Barr. Oct. 13, 1955. 2p. (SOA-187).

Evaluations of the following methods for the production of heavy water are presented: adsorption of water on char and phosphine/water, water-hydrazine/hydrogen, and methanol/hydrogen sulfide dual-temperature chemical exchange systems. It was concluded that adsorption of water on char might be a means of expanding the production of a plant by feed enrichment and that the phosphine/water system may be adapted to existing H_2S plants with minimum changes. (C.W.H.)

20760 TID-2504(Del.)(Suppl. 1)

Du Pont de Nemours (E. I.) & Co. Atomic Energy Div., Wilmington, Del.

STATUS OF HEAVY-WATER PROCESSES. V. R. Thayer. [nd]. 13p. (DPW-6662(Del.).) $3.30(ph), $2.40(mf) OTS.

The development and production program sponsored by the Manhattan District (1942 to 1945) resulted in the production of heavy water required as the moderator in experimental reactors. Production was achieved by two methods: (1) water distillation and (2) catalytic exchange between hydrogen and water. Renewed interest in heavy water as a moderator resulted in the authorization of the current large-scale production program, which is based on H_2S-H_2O dual-temperature exchange. Reasons for the selection of the processes used in both

programs are reviewed. A number of processes, including water distillation, H_2S-H_2O dual-temperature exchange, H_2-H_2O dual-temperature exchange, H_2-H_2O single exchange, and $NH_3-H_2-H_2O$ exchange are discussed, with comments as to the status of development and the probable competitive position. (auth)

TECHNOLOGY

Feed Materials

20761 MCW-1428
Mallinckrodt Chemical Works, St. Louis.
PROCESS DEVELOPMENT QUARTERLY REPORT. PART I. LABORATORY WORK. J. I. Shepardson, Patricia Fain, and J. A. Nelson, eds. Apr. 1, 1959. Decl. July 29, 1959. 84p. Contract W-2 W-14-108-eng-8. $13.80(ph), $4.80(mf) OTS.

Aqueous entrainment in the extract from the first refinery pumper-decanter was found to range from 0.7 to 2.4 volume per cent. About an order of magnitude better decontamination for sodium and similar impurities is obtained by centrifuging the organic extract. The amount of water sorbed by green salt under equilibrium conditions is a linear function of the uranyl fluoride content. Uranium tetrafluoride could not be dried in air above 400°C without serious decomposition. Experiments with "isothermal" laboratory-scale bombs indicate that preignition charge temperatures above about 300°C are necessary for production of low-hydrogen uranium. An upper limit of about 400°C on this heating was necessary to minimize premature ignition. The thermoconductivity of a laboratory bomb charge was increased by replacing part of the normal granulated magnesium with magnesium strips or larger chips. The lowest ignition temperature of heated, stirred magnesium-green salt mixtures was found to be 393°C. This indicates that preheated bomb charges could probably be handled safely at temperatures below about 300°C. A high-voltage spark discharge ignited a cold mixture of UF_4 in magnesium. The replacement of normal bomb lids and MFL charge caps with either porous graphite or firebrick produced uranium with lower hydrogen than normal bombs fired under similar conditions. Molten uranium poured through atmospheres of hydrogen, water vapor, and hydrogen fluoride picked up approximately the same amount of hydrogen from all three gases under comparable conditions. The thermal diffusivity of most MFL materials at 650°C was found to be approximately 2.0×10^{-3} cm^2/sec. An initially high diffusivity (3×10^{-3} cm^2/sec) was found in measurements on regular MFL, but this higher diffusivity decreased to a limiting value upon heating. No significant variation in thermal diffusivity was found from lot to lot of regular MFL. The rate of dissolution of uranium in nitric acid has been shown to depend on nitrous acid concentration, consistent with previous postulates of the dissolution mechanism. The occurrence of an unexpectedly vigorous reaction between uranium metal and nitric acid in the plant metal dissolver has been tentatively traced to a conditioning of the metal in a "treated water" containing small amounts of sodium dichromate, sodium triphosphate, and sulfuric acid. The conditioning process apparently produces sensitized patches of the massive pieces of uranium which react with nitric acid with greater than normal activity. The x-ray spectrographic determination of uranium through use of strontium as the internal standard has been successfully applied to the analysis of aqueous and organic solutions. The precision at the 95% confidence limit is ±1.3% relative for aqueous solutions at a uranium concentration of 1.0 g/l and ±1.9% relative for organic solutions at a concentration of 2.0 g/l. (auth)

Raw Materials

20762 AECL-858
Atomic Energy of Canada Ltd., Ottawa.
URANIUM IN THE WESTERN WORLD. A STUDY OF THE SHORT-TERM MARKET PROSPECTS FOR CANADIAN URANIUM. S. W. Clarkson. July 1959. 67p. $1.50(AECL).

The probable trends of uranium supply in the free world are examined. An analysis of all marked influences which have a bearing on the future demand for uranium is presented. Implications affecting the Canadian uranium industry are emphasized. (J.R.D.)

20763
APPLICATION OF THE ELECTRON MICROSCOPE TO THE STUDY OF URANIUM MINERALS. F. Catalina and E. Mingarro (Junta de Energia Nuclear, Madrid). Anales real soc. españ. fis. y quim (Madrid), Ser. A 55, 175-8(1959) May-June. (In Spanish)

The electron microscope was used to identify the submicroscopic hydrated uranium minerals of new formation found in the precrystalline and colloidal forms of radioactive deposits. The mineralogical transformations produced by the hydrothermal veins were studied to determine the possible correlations between the secondary minerals of the host rock and the economic importance of the deposit. (auth)